The Aviation Historian®
The modern journal of classic aeroplanes and the history of flying

TERMINAL VELOCITY

The Supermarine Swift and the 1955 White Paper

Issue No 11

Published quarterly by:
The Aviation Historian
PO Box 962
Horsham RH12 9PP
United Kingdom

Subscribe at:
www.theaviationhistorian.com

ISSUE NUMBER 11
(published April 15, 2015)

Published quarterly by *The Aviation Historian*, PO Box 962, Horsham RH12 9PP, United Kingdom

ISSN 2051-1930 (print)
ISSN 2051-7602 (digital)

Printed in the UK by
The Magazine Printing Company
using only paper from FSC/PEFC suppliers
www.magprint.co.uk

The Aviation Historian®
The modern journal of classic aeroplanes and the history of flying

Editor's Letter

JOHN STEINBECK ONCE said "You know how advice is. You only want it if it agrees with what you wanted to do anyway". Happily for me, the *TAH* Editorial Board consistently gives me the advice I want to hear. Being able to call on the expertise of such revered authors, historians, artists, engineers and pilots is a joy, and I'm delighted to welcome two new members, both of whom have provided valuable advice and superb features since our launch in 2012. Regular readers will recall Italian aviation specialist Gregory Alegi's accounts of the Campini-Caproni CC.2 "motorjet" and the procurement of Italy's World War Two DB 605-powered fighters. Award-winning civil aviation writer David H. Stringer is also well known to *TAH* regulars: his highly readable histories of the USA's sprawling Local Service Carrier and "non-sked" airlines have made a major contribution to *TAH's* reputation for "grown-up aviation history".

This issue's cover subject — the Supermarine Swift — heralds Prof Keith Hayward's masterful dissection of the politics that led to Britain's first post-war procurement crisis, which in turn informed the White Paper that bred far-reaching consequences for Britain's Cold War air defences. Controversy also pervaded the brutal Second Congo War; Tom Cooper recounts a rare occasion on which BAe Hawks, usually used for more peaceful activities, were armed to the talons and blooded in combat.

Controversy and aviation have never been strangers, as Nick Engler's analysis of the Curtiss-Langley affair — a truly shameful episode — demonstrates. Flying was barely more than a decade old before men with money to make or reputations to keep first meddled with its history. If only they'd had better advice — but you know how advice is . . .

Nick Stroud

FRONT COVER ***Fg Off Alan "Harv" Harvie on the downhill run of a loop in Supermarine Swift FR.5 WK303 of No 79 Sqn in June 1960.***

BACK COVER: TOP ***An ANA Bristol Freighter on the Air Beef run;***
BOTTOM ***From L to R: Messrs Manly, Curtiss and Zahm; see p72 . . .***

CONTENTS Issue No 11

AIR CORRESPONDENCE

Letters to the Editor

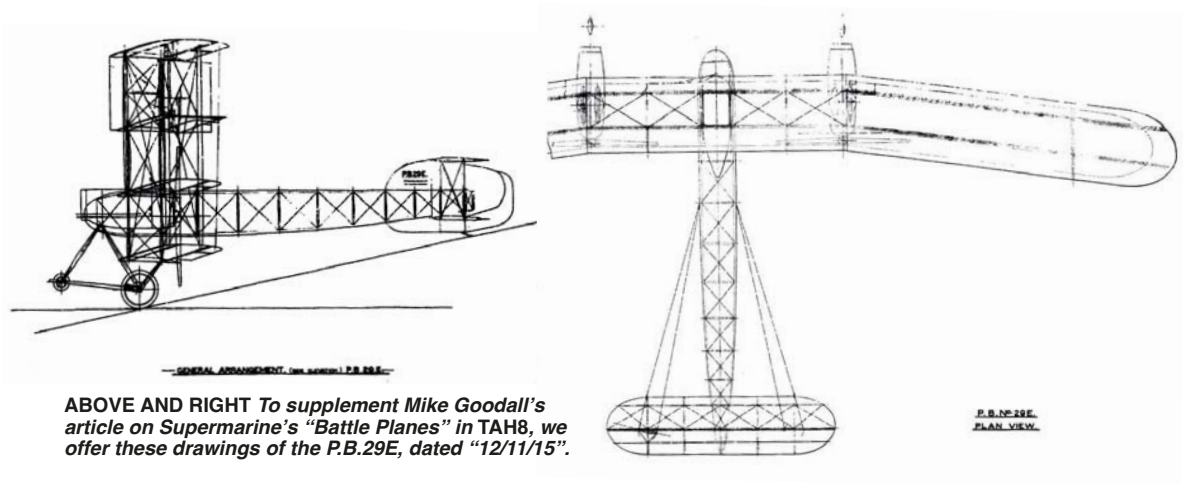
Thereby hangs a tailwheel

SIR — In the article *Polka Dot Ridge-Runners* in *TAH10*, the comment in the caption on page 60 "unusually, with the tailwheel down in flight" needs a bit of clarification. Fortunately for the USAF and UN, the government had kept hundreds of virtually new North American P-51D/K Mustangs in storage at Kelly AFB in Texas. With the outbreak of the Korean War, demand for the Mustang increased dramatically and aircraft were withdrawn from storage, put into ferry condition, and flown to numerous civilian-run overhaul facilities where they were prepared for an entirely new war. After test flying, the aircraft were preserved and shipped overseas.

In Korea the Mustangs operated mainly from primitive facilities — or excellent facilities that had been rendered primitive by enemy attack. In the new mission of ground attack, the Mustangs were carrying increased underwing loads. The actuating cylinder for the Mustang's retractable tailwheel is relatively small and it was found that, when operating from these facilities, rocks, dirt and associated debris found their way into the tailwheel compartment, often damaging the cylinder. This resulted in the tailwheel not raising (or lowering) and increased incidents resulted in vitally-needed aircraft being withdrawn from the front line while they underwent repair.

Accordingly, a technical order was issued for the Mustang's tail strut to be locked in the down

LEFT ***Although the P/F-51H never underwent the rigours of combat or operation from primitive airfields, the USAF decided to have its tailwheel fixed down. These P-51Hs were assigned to the 61st Fighter Squadron, 56th Fighter Group. See page 119 of this issue for another photograph of a Mustang in flight with a locked-down tailwheel.*** **BELOW** ***One of the major overhaulers of Mustangs was Grand Central Aircraft, located at the historic airfield of the same name in Glendale, California. Mustangs for Latin America and the USAF were flown from Kelly AFB and overhauled, retaining their retractable tailwheels.***



ABOVE AND RIGHT ***To supplement Mike Goodall's article on Supermarine's "Battle Planes" in* TAH8, *we offer these drawings of the P.B.29E, dated "12/11/15".***

position. Often, a protective canvas "boot" was wrapped around the strut. As with any other field modification, this was not done all at once and it is common to see images of aircraft operating at the same time with the two different tailwheel configurations.

With the end of the Korean War, many Mustangs returned to Air National Guard duty and it was decided — for ease of maintenance — to leave the tailwheel in the locked-down position. As a point of interest, this also applied to the later F-51H, a Mustang variant that did not see combat. When the surviving Mustang fleet was offered for surplus sale beginning in 1957, one of the first things civilian owners would do was restore the tailwheel mechanism to its original retractable configuration. In the article, please note that some of the Mustangs have fixed tailwheels while others do not.

Michael O'Leary *via e-mail*

What's in a NaMe?

SIR — In the article *Pemberton Billing and the Four-Winged Farrago (TAH8)*, your author writes of the "Nighthawk", whereas in Andrews and Morgan's *Supermarine Aircraft since 1914* (Putnam, 1981), we find "NightHawk".

"Googling" Pemberton Billing, Prodger (the test pilot) or the aircraft itself produced almost universally "Nighthawk". The bird in question is a "nighthawk" and your Phil Jarrett uses "Nighthawk" in another publication. But these entries are all post-1917 (when the aircraft first flew) and could simply be silent "corrections" of the odd-looking "NightHawk" in the Putnam book — whose authors are consistent in this spelling. Whilst R.J. Mitchell's son cannot always be relied upon, he gives "Night Hawk" which is reasonably logical — after all, a Zeppelin-chasing aircraft fitted with a searchlight on the front might be regarded as a nocturnal "Hawk".

Dr John K. Shelton *Standon, Staffordshire*

[Mike Goodall, the author of the article, replies: "Pemberton Billing, in his book* Defence Against the Night Bomber, *page 64, gives 'Nighthawk'; and, as it was his baby, I feel that he is probably the best authority no matter what Mitchell and others may have written."

So Mike's comment gives us a pretty definitive answer. It's possible that the "NightHawk" nomenclature came from some detail such as a draughtsman's graphic embellishment on the title-panel of a general-arrangement drawing. It would be most interesting to know where Andrews and Morgan got it from — Ed]

For the record

SIR — Looking back at Part Two of the Air America in Laos article *Anything, Anywhere, Anytime — Professionally* in *TAH3*, I would like to make the following comment:

On page 81, author Jonathan Pote states, "The American FAA annotated the records of some Air America and other CIA aircraft as 'File in locked drawer', presumably to avoid unauthorised investigation".

The concept is correct, but the facts are wrong. The FAA's registration and make/model/serial cards were marked "Give no information. Refer to Rob". Sometimes this was typed directly on to the card, other times it was a slip taped to the card. Rob is Lester G. Robinson, who was AAC-250, Chief, Aircraft Registration Branch, in Oklahoma City at that time. The files were in his office, but 40 years on I cannot recall whether it was locked or not. I do know he had saved other FAA files in his office such as *The Spirit of St Louis*, Earhart's Electra, and Wiley Post's *Winnie Mae*; and they were in an unlocked cabinet.

Although I had free run of the facility while he

was in charge, if I asked for one of those files he would always say "no", and they were not available by CIA request. However, he always told me when a file was "now available".

Few historians got to see the FAA cards at that time, and thus not many people asked for those files; although one has to add that often the CIA would request a registration, paint it on an aircraft, but file no paperwork, and carry no documentation. This principally seemed to be the situation of C-46s overhauled in Arizona and ferried to India: there are no records of these aircraft at all.

An interesting situation, but one that only just skirted public access.

John M. Davis *via e-mail*

More truth about UGLY

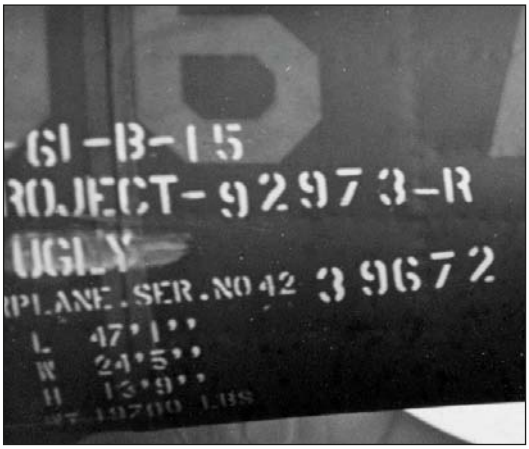
SIR — I was delighted to see in *TAH8* that Phil Jarrett had produced an article on the surface shipment of aircraft to UGLY. To add to it ***[and to elaborate on Bob Livingstone's letter in TAH9 — Ed]***, I offer the following.

While I was at the National Air and Space Museum (NASM), colleagues Larry Wilson (now retired) and Paul Silbermann and I made a concerted effort to assemble a guide to decoding the USAAF Individual Aircraft Record Card automated codes and entries, as we received a significant number of inquiries about these and, even though we had slowly accumulated a fairly good working understanding of them from experience, a number of codes eluded our understanding. I was Research Team Leader at NASM at the time.

UGLY was what was termed an Overseas Destination Code. Others that turned up with some frequency included SUMAC, FULCRUM, WILDFLOWER, HEATH, NASAL, CHEROKEE, TORCH, EBON, GLEN, DAUB, BLEACHER, MAESTRO, BIRCH, INDIGO, POPPY,

MYSTERY PICTURE Rolls-Royce formation

NEWLY-APPOINTED* TAH *Editorial Board member Gregory Alegi recently found this photograph while looking for something else. We are sure we've seen it before, but cannot recall the occasion or the story behind it. Can anyone from the readership provide chapter and verse? If so, please contact the Editor or the Managing Editor.



PHILIP JARRETT

LEFT ***A detail of the stencilling — including the "UGLY" code — on the rear fuselage of a P-61B Black Widow in transit; the complete photograph appeared in Phil Jarrett's article in*** **TAH8.** ***See Dan Hagedorn's letter on these pages.***

STRUCTURE, FANTAN, APPAREL, BENT, ACHE, VARY, OBEY, LEFT, WAGE, PIECRUST, JOGO, TRADEWIND, BLOT, SUBLIME, ELMS, CAVI, BRONZE, AHOY, GOOSEWING, DAFT, PEWTER, OILY, SOXO, RANCID, DAFT, NICE, PLOD, FOURSQUARE, REAP, COPPER, CHEEKSTRAP, SPAVIN, OBOY, MANHOLE, IRON and possibly several others we could not confirm. Note that these were equipment shipping codes and had nothing to do with APO [Army Post Office] numbers, which are a separate study for mailing destinations/stations only.

We figured out that UGLY was generally the United Kingdom, with an emphasis on Belfast, while SOXO was Eighth Air Force, England *[Livingstone says Eighth AF, Europe — Ed]*. Some of these we deciphered because they were linked to specific Aircraft Projects. CHEROKEE, for instance, was found to be Karachi, India, as of January 1, 1943; while SUMAC was Australia (later changed to SPAVIN). The entire listing of these codes goes to 13 pages, with the very last one (to give you some idea of how detailed they were intended to be in some cases) was ZOUAVE which, as of January 1, 1943, denoted White Horse, Yukon Territory, Canada.

On page 106 of his article, in the lower caption, Phil alluded to "PROJECT 92973-R" which was one of literally thousands of Aircraft Project Codes. Although we feel sure there were many others, the lowest Project number we had identified as of January 2006 was 90215, which covered seven Fairchild UC-61As for the Tenth Air Force.

Believe me when I say this is far from a comprehensive understanding of these codes. We want to believe that a "master" listing of them existed somewhere in USAAF files, but that Holy Grail hasn't turned up as yet!

Dan Hagedorn *Seattle, WA, USA*

Halcyon days

RICHARD GARDNER

FURTHER TO Richard Gardner's recollections of flying with the KC-97s of the Ohio ANG during 1969 in **A Jaunt over Germany** ***in*** **TAH9,** ***he was sorting through his slides and, he reports, "I rediscovered one depicting the late Alan W. Hall (of*** **Aviation News** ***fame) and John Bagley (of RAE and Science Museum fame) with the caravan Alan towed over the Channel on that memorable trip to Le Bourget before we continued to Germany. Many readers will remember Alan and John (seated), who both contributed so much towards the aviation enthusiast movement in the 1960s and '70s. They certainly diverted me from a 'straight and level' executive trainee life in BAA into aviation PR and journalism . . . bless 'em!"***

Ian Allan Aviation Tours presents:

World War One & Beyond

A tour of Germany, Italy, Austria and Hungary: June 14–25, 2015

12 days, 16 museums, an airshow, beautiful scenery and cities:

- Deutsches Museum Flugwerft Schleissheim
- Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik, Munich
- Zeppelin Museum, Friedrichshafen
- Dornier Museum, Friedrichshafen
- Museo del Politecnico, Turin
- Grupo Amici Velivoli Storici Workshop, Turin
- Volandia Parco e Museo del Volo, Malpensa
- Mus. d. Falegname, Almenno S. Bartolomeo
- Fondazione Vittoriale degli Italiani, G. Riviera
- Collezione Marangoni, Trento
- Museo G. Caproni, Trento
- Österreichisches Luftfahrtmuseum, Graz
- Technisches Museum für Industrie und Gewerbe, Vienna
- Heeresgeschichtliches Museum, Vienna
- Kossuth Lajos Muszaki, Budapest
- Kozlekedesi Muzeum, Budapest

In addition to the above museums/visits, we enjoy a full day at the famous Jonathan Collection's World War I Re-enactment Airshow, featuring the aircraft of Giancarlo Zanardo. This private airfield was part of the battle lines during the Great War's 1918 Battle of the Piave River. The itinerary also includes free time at leisure in Friedrichshafen, Turin, Vienna and Budapest, with an optional excursion taking in a fabulous cruise along the picturesque Lake Constance.

Tour price from £1,879 based on sharing a twin-bedded room with en suite facilities and including services of a tour manager, return flights, airport taxes and security charges. Single room supplement from £198.

ian allan Aviation Tours

0288 ATOL PROTECTED

ABTA 11185 / V4458

The Jonathan Collection's Caproni Ca.3 bomber replica in flight at Nervesa della Battaglia.
JONATHAN COLLECTION

To secure a place on this tour, or to request a copy of the full detailed itinerary, call Deborah at Ian Allan Aviation Tours on 01932 255625.

Please note prices/details are provisional at time of press. The tour is arranged by Ian Allan Aviation Tours, Terminal House, Shepperton, Middx TW17 8AS (www.ianallantravel.com/aviationtours). The tour is subject to minimum numbers.

HIGH ANXIETY

THE SUPERMARINE SWIFT & BRITAIN'S FIRST POST-WAR PROCUREMENT CRISIS

Digging deep into the archives **PROFESSOR KEITH HAYWARD FRAeS** uses official papers and contemporary documents to examine the 1955 White Paper on the supply of military aircraft, issued at a time when it was becoming increasingly clear that the nation's much-vaunted new high-altitude interceptor was falling far short of expectations

TAH ARCHIVE

"A GRAVE POSITION HAS arisen affecting the Swift single-seat fighter under construction by Vickers Supermarine".[1*] So began a secret memorandum to the Churchill Cabinet in February 1955. There had been growing internal concern about the progress of the Swift, acquired to defend UK airspace against high-level bombing attack.[2] But this stark statement gave notice of what was arguably the first major post-war crisis in UK aircraft procurement.

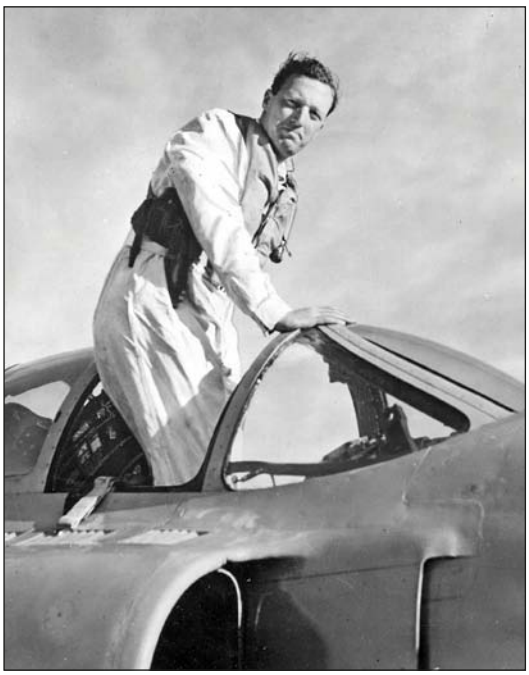
Although the sorry tale of the Swift would dominate official concerns during the early to mid-1950s, it should be better viewed as symbolising a wider set of issues and problems affecting UK Cold War military aircraft projects. There were also some unequivocal technical and operational successes — the English Electric Canberra and the "V-bombers", for example — but in general, the military procurement crisis of 1955 was symptomatic of a more fundamental struggle to come to terms with developing and procuring the more complex aircraft of the jet age.

SWIFT — FOCUS OF A CRISIS

The first production Swift F.1, WK194, made its maiden flight on August 25, 1952. It was also the last British production aircraft to hold a world air speed record, which Supermarine test pilot Mike Lithgow achieved on September 26, 1953, when he set a new record of 735·7 m.p.h. (1,185km/h) in WK198 at Castel Benito in Libya. The Swift formally entered RAF service with No 56 Sqn in February 1954. The type was found to be uncontrollable at high speeds and, if anything, the modified F.2 was even worse than the F.1.[3]

The Swift was ordered in seven variants; the F.1, F.2., F.3 and F.4 interceptors, the FR.5 and FR.6 photo-reconnaissance versions and the F.7, which was to be equipped with radar-beam-riding *Blue Sky* air-to-air missiles.[4] The type garnered little praise from the RAF, but as all 25 of the F.3s had been built, the Service had no alternative but to accept them (all became instructional airframes only), as well as the 40 F.4s originally ordered (although only eight were built as such).

By the time the Swift's shortcomings had become clear, its immediate cancellation would have cost some £21 million; completing the production order would cost £24·5 million (equivalent to some £425 million today).[5] Procurement of the FR.5 and (ultimately unbuilt) FR.6 variants would incur additional costs. Further costs would be incurred by procuring aircraft to replace the troubled fighter. In total, the Swift programme



PHILIP JARRETT COLLECTION

ABOVE ***Supermarine test pilot Lt-Cdr Mike Lithgow in Swift F.4 WK198 on his arrival at RAF Idris in Libya in September 1953, where he set a new world air speed record. No doubt Supermarine's management was delighted to have broken the previous record set by Hawker Hunter WB188 only three weeks previously.***

was to have cost £45 million (£851 million).[6] The idea of — at best — writing off more than three-quarters of a billion pounds in today's money was a daunting prospect, and attention turned to how best to announce this and explain the failure.[7] There were also strategic industrial reasons to protect the Supermarine design team.[8]

While the Swift was perhaps the worst example of cost overrun and poor performance, there were other programmes worrying the government; developments of the Gloster Javelin, for example, regarded as "our most important aircraft after the V-bombers". Designed to intercept Russian nuclear-armed bombers, the Javelin was fundamental to the strategic defence of the UK. Since it was an Allied asset, procurement was partly financed by the USA. But as the Minister of Supply noted, the so-called "Thin-Wing Javelin" (TWJ) project might "never become a satisfactory fighting machine" unless more money was spent on development and at the cost of a "serious delay".[9]

By 1956 the TWJ's development problems were

OPPOSITE PAGE ***The Supermarine Type 535 research aircraft, serialled VV119, was essentially the prototype of what would develop into the Swift, and was used memorably in the filming of David Lean's*** **The Sound Barrier.**

** Endnote references, indicated by numbers at appropriate points in the text, are provided at the end of the feature.*

TAH ARCHIVE

ABOVE ***A characteristically superb portrait of the first pre-production Swift, WJ960, by the doyen of aviation photographers, Charles E. Brown. This production prototype was essentially similar to VV119 but with longer-span ailerons. Built at Hursley Park, the aircraft made its maiden flight on August 1, 1951, from Boscombe Down.***

easing, but its in-service date had slipped to 1961, two years later than planned. The Minister of Supply was far from complimentary: "I have little confidence in the Gloster Company, which is one of the weakest in the industry" — a view which would anticipate a later, more fundamental, review of the UK aerospace industry.[10]

In public, throughout 1954, news of UK military aviation progress was upbeat. The SBAC airshow at Farnborough in September was its usual parade of British aircraft; the Swift generated sonic booms to widespread satisfaction. However, in line with usual British practice, actual performance and other data was closely guarded.[11] Earlier that year, the Minister of Supply, Duncan Sandys, announced satisfactory progress on the Swift and that its introduction, "with its superb flying performance and terrific firepower, is a milestone in the progress of Britain's air defence" and was "greatly impressed" generally with the state of the military programme.[12]

Out of the public eye, however, officials were less sanguine; the UK was falling behind the Americans and the Russians, and without a massive increase in resources and some radical changes to the shape of the domestic aircraft industry, the gap would widen still further. As a comparative review put it only a year or so later, "It is unlikely that we [will] close, or even hold steady, the performance gap between British and American aircraft in the foreseeable future".[13] In short, towards the end of 1954, there was a growing official consensus that something had to be done to improve the way in which the UK ordered and developed its military aircraft. This embraced ministry organisation and procedures and, increasingly, the structure and efficiency of the domestic industry.

THE 1955 WHITE PAPER

Any hopes that the problems affecting the supply of military aircraft could be kept secret were rapidly fading as the problems with a number of projects began to leak. Questions in the House of Commons about the rate of progress in supplying military aircraft were growing in frequency, as were "unofficial reports" about the limitations of the Swift's high-altitude performance.[14] There were also a number of uncomfortable headlines in national newspapers, as in September 1954 when the *News Chronicle* asked *"Where are the Planes?"*.

By the new year the Cabinet had decided that the Government had to come clean about the nature and extent of the crisis — as far as it was politically safe so to do. In January 1955 the Cabinet agreed to publish a White Paper, *The*

TAH ARCHIVE

ABOVE ***Swift F.1 WK198 was modified to become the prototype Mk 4 (given the company designation Type 546), and is seen here on a test flight before Mike Lithgow's assault on the world air speed record. The Mk 4 introduced a variable-incidence tailplane, which, it was hoped, would alleviate the type's notable pitch-up characteristics.***

Supply of Military Aircraft.[15] But given growing press speculation, there was also a question of how to announce its publication and to manage the subsequent Parliamentary debate. As the Chancellor of the Exchequer, R.A. Butler, noted: "Care would be needed in presenting to the public the Government's decisions on future production of the Swift aircraft". On the one hand, it was "important to avoid any impression that the programme of Swift production had been a total failure". On the other hand, as the future of these aircraft was still far from certain, the Government "would be well advised to say nothing which it might latter have to retract".[16] Some of the blame could be shifted on to the previous administration, which had misjudged the need for a second generation of fighter aircraft, but there were limits to this strategy; as one Minister would later observe: "The record is not a happy one. The situation which we inherited in 1951 was not good, but we can no longer hide behind the sins of omission of our predecessors. Candour compels me to say that I do not think the record in the last 3½ years has been satisfactory".[17]

In the event, the White Paper was something of a classic piece of Whitehall drafting. At its core was the Swift fiasco, but surrounding it was a much lengthier explanation of post-war aircraft development and the military exigencies that had led to the concurrent development and production of both the Hawker Hunter and Swift and other fighter aircraft, as well as a description of its successes (largely the V-bomber programme and the Canberra). There was also a forward look aimed at modernising the system by which complex military aircraft were to be developed and procured in the future.

The White Paper described the immediate post-war period as being characterised by a combination of strategic uncertainty and economic austerity.[18] Developing a British atomic bomb and the means to deliver it had a clear priority, but spending on conventional weapons would be curtailed both for reasons of economy and to allow time for new technologies, such as the jet engine, to mature. This principle was enshrined in the "Ten-Year Rule", which assumed no major conflict for Britain within the decade and which in 1948 had led to the cancellation of a number of fighter projects that would have superseded the Meteor and Vampire.

Combined with some inherent conservatism on the part of Government scientific advisors, decisions were also taken to proceed cautiously with a number of research projects, which had the dual purpose of keeping design teams in business

TAH ARCHIVE

ABOVE ***The Gloster Javelin FAW.1 all-weather interceptor entered RAF service in February 1956, having suffered from its own considerable development problems. A "thin-wing" development of the type was planned, for which components and sub-assemblies were completed, but the project was ultimately cancelled in the summer of 1956.***

but deferring procurement. In total, there were 26 active research projects during this period, costing just under half a billion pounds out of a total aircraft spend of £34 billion, which to a Commons Select Committee, did not "seem to be excessive".[19] This had little negative effect on the strategic-bomber programme, as a protracted development of the delivery system would be in step with building the atomic bomb. But the impact on UK fighter aircraft was more serious. First, it delayed development of supersonic concepts; secondly, when the UK was involved in a serious shooting war, its fighter aircraft were inferior to both its allies and its adversaries.

This strategic complacency was shattered first by the Berlin crisis of 1948, and more seriously by the outbreak of the Korean conflict in 1950, which triggered a massive British rearmament programme, forcing the purchase of more already obsolete British jet fighters and Canadair-built F-86 Sabres. More importantly, the emergency led the Ministry of Supply (MoS) to order promising designs "off the drawing board", which entailed a commitment to production in the early stages of development and well before any major technical problems emerged. The Hunter and Swift were assigned this accelerated status.[20] With so many projects rushed into production, however, severe bottlenecks resulted. The adoption of a "Super Priority" scheme proved to be no panacea, as so many projects were awarded this status. While the Hunter experienced a number of serious problems during its expedited development, some of these had been partly resolved by 1953, and the shapely fighter went on to become one of Britain's most successful military aircraft.[21] The Swift did not.

DISAPPOINTMENT AND DISASTER

Having outlined these development issues, the 1955 White Paper then sketched briefly the history of the Swift programme, describing how, despite the development of four variants, the aircraft was still unable to meet its specification, with an overall performance described as "disappointing". Other problematic aircraft such as the Javelin were given less attention. In some respects, the Javelin was a more significant programme that began to go wrong during this period.[22] Later, the Ministry would tell a House

The Swift F.1 served with only one unit, No 56 Sqn, with which it entered service in February 1954 at Waterbeach in Cambridgeshire. Nearest the camera is WK208, lost after it became uncontrollable on May 13, 1954. All Swifts were grounded for two months as a result.

TAH ARCHIVE

TAH ARCHIVE

ABOVE ***The Swift F.3 variant — the first of which, WK247, is seen here — was similar to the F.1 and F.2 but introduced reheat for its Rolls-Royce Avon engine. All 25 F.3s ordered were built, but none entered squadron service. All except WK248, which went to the College of Aeronautics, were instructional airframes by the end of 1956.***

of Commons Select Committee that it would be "wrong to say that the whole [Swift] aircraft was a disaster", and claimed that the problems were due to the "exceptional nature of the circumstances surrounding the Swift and the decision to develop it so quickly". However, the Commons Select Committee later reported that the Ministry should have cut its losses earlier than it did.[23]

The remainder of the White Paper focused on the future. In the first place, an "adequate programme of research and the necessary capital facilities for such a programme are vital for success". Plans were in train for such a programme with the Ministry and industry collaborating.[24] It noted that many of the problems had derived from the increasing complexity of modern aircraft.[25] Significantly, past practice of developing aircraft equipment separately from the airframe was no longer valid. Henceforth the approach would be based on an integrated "weapons system" concept. Ideally, "the complete responsibility for co-ordinating the various components of the system should rest with one individual — the designer of the aircraft".[26]

Some of these concepts had in fact begun to percolate around the UK procurement establishment in 1954. Much of the groundwork was performed by an MoS working party dedicated to the theme of speeding up aircraft production. This included extensive consultations with British aircraft manufacturers. A key issue was the bottlenecks caused by building too few prototypes. Ministry thinking turned to ordering aircraft as pre-production "Development Batches", although there were concerns about how exactly this would further the early stages of development and whether it might complicate the transition to production models. The English Electric P.1 (developed into the Lightning) was the first example of a Development Batch contract.[27]

Overall, the sentiment that something more radical had to be tried was strongly evident in these official discussions. Involving industry earlier in the formulation of operational requirements was another item on the agenda. In the event, the current approach was felt to be satisfactory, as long as the concept of weapons-systems development was driven home. However, more could be done to discuss with industry broad background issues, giving access

Swift FR.5 WK315 served with No 79 Sqn, which replaced its Meteor FR.9s with the variant in June 1956, operating the Swift in the fighter-reconnaissance role in Germany until the end of December 1960. Artwork by JUANITA FRANZI / AERO ILLUSTRATIONS © 2015

TAH ARCHIVE

ABOVE ***From nearest to furthest from the camera, the first, second and fifth pre-production examples of the Blackburn NA.39, which would evolve into the Buccaneer. Ordering a pre-production batch, rather than the usual single prototypes, meant that there were sufficient trials aircraft to permit a far more efficient test programme.***

to appropriate technical and research studies on emerging defence trends that could inform the requirements process.[28]

It was a difficult sell. The MoS was caustic about the Air Staff's informal relations with companies and the way it tended to allow "an arbitrary selection" of firms to discuss future requirements. This had been applied to discussions on a future supersonic fighter. These were "almost entirely related to the aircraft vehicle. Thereby they misled many firms into doing a great deal of work which is now shown to be virtually useless . . . any work by the aircraft designer on a knowledge of the performance of the aircraft vehicle alone is largely wasted. We have to educate the Air Staff, the industry and indeed ourselves to think in future in terms of a complete weapons system and no longer of an airframe alone".[29]

Ministry officials also debated whether the weapons-system approach implied the selection, as it did in the USA, of a "prime contractor" responsible for designing and integrating the entire system. This would certainly challenge the established system of "embodiment loan", whereby equipment was procured and developed separately, with only general characteristics available to the platform design team. While this situation was increasingly untenable, the Ministry was reluctant to accept such a radical change, that a lead contractor should increasingly take responsibility for "co-ordinating" work between airframe and equipment designers.[30]

The White Paper went on to observe that the extended development period needed for a modern aircraft carried with it the threat of obsolescence. This underlined the need for adequate research as well as effective relations between procuring ministries and industry. To speed up the process, the White Paper announced that aircraft would no longer move from prototype to pre-production variant, but would be procured in Development Batches, as initially proposed by the 1954 MoS working party.[31] It was also considered desirable that design innovation might proceed in "shorter steps". In short, these changes might imply greater initial expenditure but better "economy of the nation's resources and an increase in its preparedness at any point".[32]

The Blackburn NA.39, Gloster's improved Thin-Wing Javelin and further development of the Lightning were initial candidates for this new approach. The need for a more integrated view of development was perhaps best illustrated by the Hunter's engine-surge/gun problem. As Prime Minister Anthony Eden later put it, the Hunter was "a melancholy story. What will happen to our name and fame when all of this is known, as I fear it must be among our allies? I hope everything is being done to avoid similar troubles being found at a later stage in the development of our next fighters".[33] However, the failure to sort out the exact relationship between companies and procurement ministries would be an important contributory factor in the next serious procurement crisis — the BAC TSR.2.

THE AFTERMATH

The fate of the Swift still had to be decided. Although a small number of aircraft had entered squadron service, the Air Ministry simply refused

TAH ARCHIVE

ABOVE ***A magnificent Cyril Peckham study of the prototype Hawker P.1067, WB188, in 1951, the year in which the shapely fighter made its maiden flight. The Hunter, as it became, was the Swift's main rival for the high-altitude interceptor role. It too suffered from development problems, but went on to become a world-class success.***

to accept the first 25 aircraft and demanded that the cost should fall entirely on the MoS budget, a demand which was stoutly rejected. There was then what to do with 40 Swift F.4s then in production, out of an original order for 263. It was suggested that they could be used as trials aircraft for engine reheat research. The Air Ministry was reluctant to take the Swift FR.6 as a photo-reconnaissance platform and was angling for more Hunters (and was interested in the Folland Gnat). The Swift F.7 would at least have the radar necessary for the *Blue Sky* (Fireflash) missile, part of the original requirement for a high-altitude interceptor.[34] In the event, only 14 F.7s were built and none entered service with the RAF. They were used as trials aircraft for the Fireflash.

From a Treasury perspective, the primary objective was clear: "If the Swift finally disappears from the fighter programme, the amount of money lost — which will be substantial — shall as far as possible be minimised".[35] Officials were also quick to reinforce the view that while current exigencies implied a continuing spend on military aircraft, "the warning of a financial limitation should be repeated".[36] There were also warning shots over the White Paper's central proposals for the future. Although the Treasury conceded, with some masterly understatement, that reform was perhaps needed — "there are already good grounds for thinking that we have not had value for all the money expended" — an official observed that "there appears a tendency on the part of the Air Ministry and the MoS to regard the Development Batch procedure as the cure-all in the development and speedy production of efficient aircraft". The NA.39 procurement had been allowed to go forward as a Development Batch, but "we have made it clear that we shall wish to deal with each case on its merits". The shorter-steps approach would also be expensive, and as such, a note of caution would be required in respect of the financial implications of the proposed new approach.[37]

There was also the question of the industrial

Swift F.7 XF118 was one of ten operated by the Guided Weapons Development Squadron at RAF Valley from June 1957 until December 1958, and was used for intensive trials of the Fireflash air-to-air missile, an example of which is seen mounted beneath the wing. Artwork by JUANITA FRANZI / AERO ILLUSTRATIONS © 2015

TAH ARCHIVE

ABOVE ***The English Electric P.1A prototype, WG760, made its first flight on August 4, 1954, and was the basis for the Lightning, the RAF's first true supersonic fighter, capable of exceeding the speed of sound in level flight. The Lightning would be one of the few survivors of the radical changes in procurement policy during the 1950s.***

implications; first for Vickers Supermarine, whose design team needed some protection as it was developing the Scimitar. Secondly, and not for the first or last time, there was concern over employment at Short Bros & Harland Ltd, a major subcontractor on the Swift. With the cancellation of all 31 Swift FR.6s, job losses in Northern Ireland would be considerable. Therefore, if an order for an additional 17 Canberras was to be placed to cover the photo-recce requirement, Short Bros must benefit from the additional work. Accordingly, George Nelson, the Managing Director of English Electric Aircraft, was to be told he would have the order but only if "he promises to subcontract ten to Short", even though Short Bros work "tended to cost more."[38]

WHAT HAPPENED NEXT?

The Government was content to ride out the subsequent debate and the public embarrassment, facing only a relatively mild set of conclusions and recommendations from the Commons Select Committee on Estimates in 1956.[39] But behind the scenes there was still disquiet about how exactly to proceed. This was also the year that saw the first glimmerings of what would be dramatically announced in the infamous Defence White Paper of 1957. At the same time, the MoS began serious work on how to encourage industrial rationalisation, which included consideration of "candidates for relegation". It also recommended a close examination of the number of projects then under development, especially in the light of the new ballistic and other missiles for both attack and defence.[40]

The immediate post-war security environment generated a whole set of uncertainties, including technological trends affecting military aviation. Equally, with so much priority afforded to the nuclear weapons programme and creating the associated bomber force, it was little wonder that the Labour Government adopted a conservative and financially prudent approach to conventional aircraft development (the cautious approach to manned supersonic flight perhaps being more arguable). The rapid deterioration in the UK's security environment, culminating in the Korean conflict and rapid rearmament, forced a number of procurement expediencies, which in retrospect seem ill-judged and poorly implemented. These emergency measures undoubtedly contributed to the problems in the supply of military aircraft experienced during 1954–56.

The House of Commons Select Committee was prepared to forgive mistakes made under the stress of events, although it was influenced by some carefully disingenuous official evidence. The machinery had revealed some weaknesses, but "it would not be fair to those concerned [to say] that a great deal had not been achieved". The system had produced "some of the finest aircraft in the world" and, on balance, had achieved this with economy. The programme had been over-ambitious, and more scrutiny of projects would be essential in the future. Failure to do so "may well place the whole programme in jeopardy".[41]

REFERENCES

1 *Aircraft Production: the Swift*, Memorandum by the Secretary of State for Air and the Ministry of Supply, February 10, 1955; The National Archives (TNA) CAB/129/73

2 A Report by the Committee on Defence Policy, submitted to the Cabinet, July 24, 1954; TNA CAB/129/69

3 See www.airvectors.net/avsuper.html; TNA CAB/129/69

4 This was the Fairey Fireflash, Britain's first air-to-air missile

5 The figures in parenthesis are 2015 values, and assume an average inflation rate of two per cent per annum

6 TNA CAB/129/69, op cit

7 TNA CAB/128/28. Minutes of Treasury Meeting February 28, 1955, TNA T225/378

8 TNA CAB/129/69, op cit. Second Report from the Select Committee on Estimates, Session 1956–57, *The Supply of Military Aircraft*, House of Commons Paper 34 (HC 34), paras 28–31

9 Report from the Minister of Supply to the Prime Minister, July 9, 1955. TNA PREM 11/806

10 Memo to Prime Minister from Minister of Supply, May 28, 1956, TNA PREM 11/1712

11 *Flight's* annual review of military aircraft also gave the impression of satisfactory progress with the Hunter, Swift and Javelin. The Fairey Gannet was also experiencing severe problems during development. In May 1954 Sir Roy Fedden, a leading UK industrialist, expressed grave concern at the rate of progress in UK aircraft developments. See *Flight*, May 21, 1954, p643; June 25, 1954, pp822–823; September 17, 1954, passim

12 *Flight*, April 2, 1954, p386

13 Even the Dassault Mystère IVB was felt to be superior to the Hunter. See memoranda from Secretary of State for Air to the Prime Minister, January 1, 1955, and February 7, 1956. TNA PREM 11/06. Secretary of State for Air to the Prime Minister, February 7, 1956, TNA AIR 20/8572

14 See reports in *Flight* regarding Parliamentary debates; December 31, 1954, p920 and February 11, 1955, pp162–163

15 *The Supply of Military Aircraft*, HMSO, February 1955, House of Commons Command Paper (Cmnd) 9388

16 Minutes of Cabinet meeting, February 22, 1955, TNA Cab/128/28

17 June 23, 1955, TNA PREM 11/806

18 See Keith Hayward, *The British Aircraft Industry*, Manchester 1989, pp59–63. See also statement by George Ward, Under Secretary of State for Air, Hansard, March 18, 1952, col 2106

19 HC 34 op cit, paras 15–20. In a flash of *déjà vu*, one can cite a modern procurement chief describing this as the "conspiracy of optimism"

20 Some of the challenges of ordering "off the drawing board" were described by a Hawker executive, including finding enough firms to make the jigs required for production when all manufacturers were claiming the same level of preference. *Flight*, May 7, 1954, p597

21 Prime Minister memorandum to Minister of Supply, August 23, 1956. TNA PREM 11/1712; *Flight*, April 2, 1954, p386

22 The Javelin was planned to be the heart of the UK's air defence against the Soviet bomber force and its procurement was partly funded by the USA as an Allied asset. By 1955 it too was behind schedule with inadequate performance compared to its intended adversaries. Later in 1955 the Government announced a slow-down in Javelin production, denying that there were any serious problems in developing the aircraft fully to operational standards. See memoranda to the Prime Minister, June 3 and 23, 1955. TNA PREM 11/806; Cmnd 9388, op cit paras 30–35; *Flight*, July 15, 1955, p72

23 HC 34 op cit, paras 39–45

24 Cmnd 9388 op cit, paras 44–46

25 HC 34 op cit, paras 62–65. Minutes of the Defence Committee of the Cabinet, May 31, 1956, TNA PREM 11/1712

26 Cmnd 9388 op cit, para 47

27 Ministry of Supply memorandum *Speeding Up Aircraft Production*, March 1, 1954, TNA AVIA 65/31

28 Ibid

29 Ibid

30 HC 34 op cit, para 104

31 Cmnd 9388 op cit, paras 48–62

32 Ibid, paras 62–63

33 August 16, 1956, TNA PREM 11/1712. It would be nearly two more years before modifications to Hunters in service and in production would be completed

34 TNA T225/378, February 28, 1955

35 TNA T225/378, February 10, 1955

36 Ibid

37 TNA T225/378, July 9, 1955

38 TNA T225/378, February 28,1955; TNA CAB/128/27 and TNA PREM 11/1712

39 HC 34 op cit, passim

40 Ibid, paras 107–115

41 Ibid, para 131

What the committee and the MoS could not fully appreciate was that aircraft procurement had already been affected by the pernicious problems of rising "inter-generational" costs and the issues associated with managing increasingly complex combat aircraft. When combined with an ambitious programme sustained by a weak and dispersed industrial base, the structural and organisational weaknesses of the procurement system were all too apparent. The response was a series of reforms that on the one hand reflected some of the new realities of weapons-systems development, as well as triggering a necessary, if belated, rationalisation of the aircraft industry.

The problem of rising project costs and the appropriate way of managing complex defence programmes would not go away, and by the early 1960s the UK government faced a succession of procurement crises, the most problematic being a survivor of the Sandys White Paper, the TSR.2. Looking back on the 1955 White Paper, it is now evident that the UK had embarked on a long and unforgiving road of procurement reform, trying to create a system that would deliver effective weapons on time and close to the original estimated costs — still a work-in-progress.

Echoes from Dawn Skies

A Lost Manuscript Rediscovered

In the sixth part of our exclusive serialisation of **FREDERICK WARREN MERRIAM's** unpublished volume of collected early-aviation memories, *Echoes from Dawn Skies,* Merriam catches up with two of Britain's arguably lesser-known pioneers, Sydney Sippe and Henri Biard, both of whom made invaluable contributions to early British aviation. Sippe leads off with early memories of Brooklands

THE STORY SO FAR: Shortly before his death in 1956, aged 76, renowned pioneer pilot and flying instructor F.W. Merriam — who in 1912 was the first man to fly an aeroplane through cloud — completed a book manuscript, entitled *Echoes From Dawn Skies.* It comprised recollections of the early years of flying, gathered from his contemporaries, many of whom had by then become leading figures in the aviation world.

Seeking "to present a more personal and intimate picture than has yet been produced", Merriam had asked them each to "contribute a story of a personal nature, something that had never before been published".

The result was a treasure-trove of fresh, first-hand insights into the lives, the work, the unquenchable spirit and the humour of these early flyers. Sadly Merriam died before the book could be published, and the priceless manuscript vanished into obscurity for more than half a century . . . until, in the summer of 2013, it came to the attention of *The Aviation Historian.* Merriam's granddaughter, Sylvia Macintosh, aware of the manuscript's importance and keen to see it finally in print, discovered *TAH* and got in touch with Managing Editor Mick Oakey, who immediately set the wheels in motion. As Mick says, "Reading the material today is the next best thing to teleporting back in time and sharing a pint or a convivial dinner with these remarkable men".

Two of Merriam's chapters from *Echoes From Dawn Skies* feature testimony from fellow British pioneers Sydney Sippe and Henri Biard; Merriam prefaced the former's contribution with the following words:

"Many highlights reflect from the career of Major Sydney V. Sippe OBE DSC. The amount of work he crowded into the early days before joining the Royal Naval Air Service in 1914 is quite remarkable. He built a metal machine in 1910 which proved too underpowered to fly; presumably the structure was too heavy for the low-h.p. engine. Eyewitnesses said it did leave the ground, but Sippe modestly disowned this credit.

"He was the first to employ steel and oxy-acetylene welding in aeroplane construction. Besides undertaking important experimental flying, he was the first to test the higher-speed machines as they gradually came into being.

"The spirit of the old days shines through the modest lines Sippe has added to fill these pages . . ."

HAPPY BUT BROKE

MAJOR SYDNEY V. SIPPE (1889–1968) & HENRI C. BIARD (1892–1966)

"I THINK THAT the most exciting moment of my life was when I walked from my lodgings, across Brooklands, to the sheds at the Byfleet side. It was very early on a lovely spring morning and the smell of the pines was intoxicating. The day before, I had signed with A.V. Roe to work in the sheds at the wage of £1 a week. I was treading on air.

"My work entailed assisting to maintain and repair engines and aeroplanes, and I remained with Roe until I got my "ticket" (Royal Aero Club Aviator's Certificate No 172). One passenger flight with Howard Pixton, followed at long intervals by a little taxying, brought me to my first solo. I think I had two altogether. Then I took the tests. My total flying and taxying time up to the tests was only part of an hour.

"Incidentally, I thought my first solo was a perfect flight, but when I saw [Frederick] Raynham's face I realised he was thinking more in terms of a perfect FRIGHT!

"We had a fine party of chaps with A.V. Roe in those wonderful 1911–12 days. Dear A.V. was always there. Then there was Ronnie Kemp, chief of the establishment; Freddy Raynham, ex-pupil and now expert; Louis Noel; Albert Hunter and myself, among others more transient.

Sydney V. Sippe beside the Hanriot monoplane he imported from France in 1912 and flew in the first Aerial Derby from Hendon, in June of that year. Unfortunately the Hanriot suffered engine problems and Sippe was forced to withdraw.

PHILIP JARRETT COLLECTION

S.V. SIPPE : "THE MAJOR"

SYDNEY VINCENT SIPPE (pronounced "Sippy"), seen *above right*, was born in Brixton, London, on April 24, 1889, and was educated at Dulwich College during 1903–05. In 1909 Sydney and his brother Arthur built a monoplane of their own design, which crashed during its maiden flight at Addington in April 1910. Sydney gained his licence in January 1912 and in April that year piloted an Avro Type D seaplane to make the first flight from the sea in Britain. He went on to have a distinguished military career during World War One, rising to the rank of Major — the title he was known by thereafter.

[For more on Ronald Kemp and F.P. Raynham see Echoes From Dawn Skies: Birds of a Feather *in* TAH10 *— Ed.]* I always remember my boss raking through the soft sand floor of the shed, searching for nuts and bolts and anything else suitable for pressing into service again.

"We were terribly happy, and naturally quite broke. But it did not matter. The vital interest was there and the enthusiasm fully made up for the lack of pennies. Of the good fellows of early Brooklands few remain, but it is most satisfying for the survivors to be able to look back on those marvellous days and remember the many stalwart friends."

Following on from Sippe's rather brief recollections, Merriam added a postscript, in which he joined Sippe in recalling those happy, if financially straitened, times at Brooklands. He concluded Sippe's chapter with the following:

"There is a photograph which shows a few of these [old friends]. It was taken at the back of the Blue Bird Restaurant, where we used to dump aircraft and car wreckage, and where we would often sit to air our views after luncheon. Sippe can be seen in the driver's seat."

HENDON MEMORIES

Merriam opened the next chapter of *Echoes From Dawn Skies* with some memories of the activities at Hendon and the people there while he was instructing at Brooklands, before going on to extract a wince-inducing — and no doubt perfectly true — story from one of the more colourful characters of early British aviation history — Henri Charles Amedie de la Faye Biard. We publish the chapter in its entirety here for the first time. Merriam takes up the story:

Our neighbours at Hendon were also very busy making history. There were the schools; that of Claude Grahame-White and others,

BELOW ***Sippe at the controls of the Avro Type D seaplane at Cavendish Dock, Barrow-in-Furness, in April 1912. The series of flights Sippe made from the water that month proved the feasibility of marine aircraft. Sippe joined the Royal Naval Air Service in 1914 and participated that November in a famous bombing raid on Friedrichshafen.***

PHILIP JARRETT COLLECTION x 2

F.W. MERRIAM ARCHIVE

ABOVE ***The photograph mentioned by F.W. Merriam, in which the Brooklands gang pose in a car made of wreckage behind the Blue Bird Restaurant. Merriam (in hat) sits beside F.P. Raynham in the rear seats, and Sippe is nearest the camera on the front seat.***

BELOW ***One of the great British aviation pioneers, B.C. Hucks gained his Aviator's Certificate on a Blackburn monoplane at Filey in May 1911. He served with the Royal Flying Corps during World War One, but died of pneumonia in November 1918.***

PHILIP JARRETT COLLECTION

including the Beatty School. George W. Beatty, an American, brought a Wright [Model B] biplane over to England for instructional purposes.

Other work apart from the schools at both places was very considerable. At Brooklands we did such experimental flying, whereas Hendon went "flat out" for exhibition work. We visited to chat and watch each other's progress, but these visits were not flying ones, except for one very rare occasion, when I remember Grahame-White, Gustav Hamel and Jimmy Valentine braved both elements and machines to come and see us.

While at Hendon we should find time to mention a few of the wonderful pioneers there: Marcus Manton, B.C. Hucks, Lewis Turner, W.L. Brock, W.H. Ewen, Frank Goodden, the Slack brothers, Pierre Prier, Pierre Verrier, Lt J.C. Porte, L.A. Strange and H.C. Biard.

The late Bentfield Charles Hucks (Royal Aero Club Aviator's Certificate No 91) was the great exhibitionist there and the first Englishman to "loop-the-loop" *[in September 1913 — Ed].* My endeavours have sadly failed to contact any of the others with the exception of Biard, now Captain RAF (Ret'd), who trained at the Grahame-White School (Royal Aero Club Aviator's Certificate No 210), and later assisted with instruction there.

Biard went on to win the Schneider Trophy air race in 1922, and became the holder of the world's air speed record for seaplanes in 1925. I had many opportunities at Southampton to

watch and admire his handling of seaplanes and flying-boats in the later days. I asked him if he had any regrets for having taken up flying. He replied:

"No, from the first time I took an aeroplane into the air out of Hendon in 1911, to the last time I flew one out of Hendon in 1944, every moment was a joy to me.

"The only thing which grieves me about it is that one can not go on flying as long as one can some other things. Had I stuck to my first idea of the sea, I should probably still captain my own ship."

"THAT DIRTY DEVIL BIARD . . ."

With regard to the story I asked him for, Biard (**INSET ABOVE RIGHT**) said, "I don't know if you can use it; it is perfectly true, but I don't want to shock anyone". He continues:

"When the first of the Southampton flying-boats had been finished and tested at Supermarine, it had to be delivered to the Marine Aeroplane Experimental Establishment at Felixstowe. It was naturally a great occasion for Supermarine and one of the few occasions on which R.J. Mitchell, who went on to design the Spitfire, accompanied me in a machine of his own design.

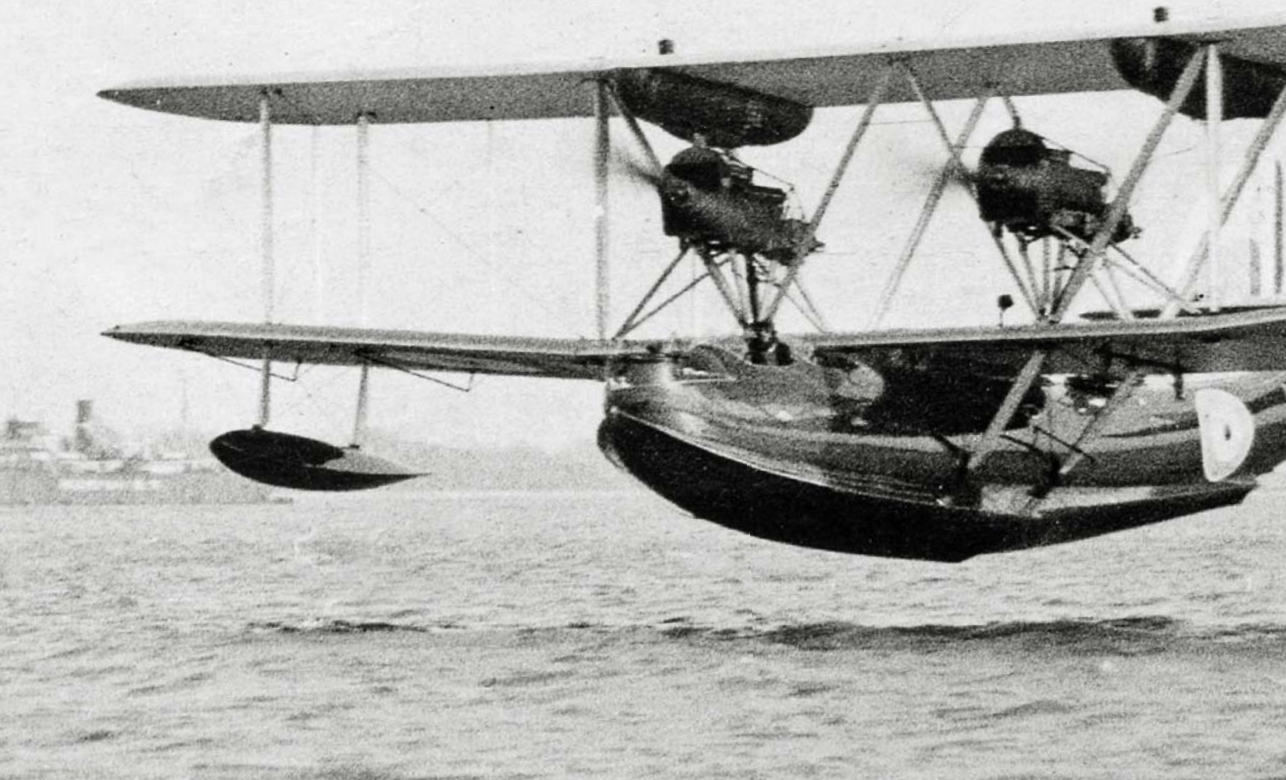
"The Southampton's hull was of wood; a beautiful thing. Under the control column was a wooden box which was later to contain a battery, but on this flight it was empty. Having foolishly drunk several cups of tea before starting, I was faced with a human emergency halfway to Felixstowe. There was nothing else to do except 'make my excuses' to the control column. I had to return to Southampton, but Mitchell stayed with the machine at Felixstowe.

The next day the machine was hauled out of the water and the experts, with Mitchell, were examining the beautiful hull. One of the experts said, 'It's strange, there's not a drop of water in the hull, but this box under the control column is half full'. 'Yes,' said Mitchell, 'that is strange'.

"The expert then put his hand in the wooden box, and, scooping some of the liquid out, tasted it. He said, 'Funny, it looks like water but tastes more like benzole'. Then suddenly his face changed, and Mitchell instantly solved the problem. 'It's that dirty devil Biard'. It took him months to live it down!"

BELOW ***The first production Supermarine Southampton, N9896, made its first flight in the hands of Henri Biard on March 10, 1925. After passing its tests at the Marine Aircraft Experimental Establishment, the type was put into production, the RAF's No 480 (Coastal Reconnaissance) Flight receiving its first examples a mere six months later.***

PHILIP JARRETT COLLECTION



PHILIP JARRETT COLLECTION

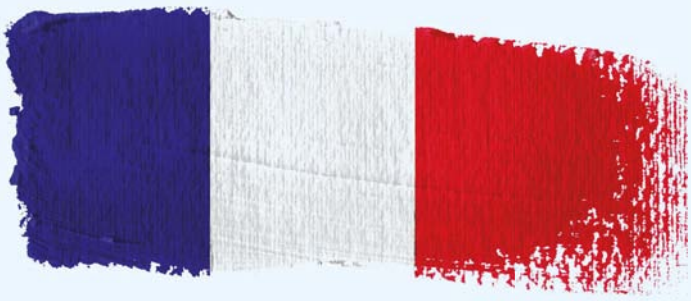
ABOVE ***Supermarine staff line up in front of the sole Swan flying-boat (initially an amphibian) during a visit by Edward, Prince of Wales, in June 1924. Among those present are designer R.J. Mitchell (third from right), and partly obscured by Mitchell, Henri Biard, who had made the aircraft's maiden flight that March.***

NEXT TIME . . .

In the next instalment of *Echoes from Dawn Skies*, Merriam turns the spotlight on one of his former pupils, engine genius Frank Halford, who recalls his long-distance contribution to Amy Johnson's record-setting 1932 solo flight from London to Cape Town in a Puss Moth

JOHN STROUD © A FLYING HISTORY LTD

The SNCASO SO.30P Bretagne was one of several types developed for the post-war mailplane/airliner market in France, and was in the same general class as Britain's Airspeed Ambassador and the USA's Convair 240, although the French machine was slightly smaller than both.



rule bretagne!

In the spring of 1940 France's thriving aviation industry underwent a traumatic transition from optimism to occupation. One company cannily spirited away its elegant transport aircraft designs until it could return to develop them after *la libération*. ROD SIMPSON traces the career of the SNCASO SO.30P Bretagne, France's twin-engined, twin-finned "pocket-Connie"

FOR THE FRENCH aircraft industry, the relentless technological progress of World War Two presented numerous challenges and much uncertainty. When war broke out, every aircraft manufacturing company in France was engaged in development projects; the *Société Nationale des Constructions Aéronautiques du Sud-Ouest* (SNCASO) was no different, and had two major transport aircraft projects in hand. The company was one of several formed when the French Government nationalised the aviation industry in 1936, and comprised six businesses, including those of Bloch, Blériot and Lioré et Olivier. In 1940 SNCASO's designated area was in the west of France, but a number of its engineers refused to work for the German occupiers and moved to a factory at Chateauroux in the as-yet non-occupied sector south of Paris.

The Bretagne's forerunners

The following year SNCASO established the *Groupe Technique de Cannes* and relocated the engineers to Cannes-La Bocca in the Côte d'Azur. At this time, southern France had still not come under German control and the SNCASO group was able to continue with development work on its SO.90 Casiopée light transport and the larger SO.30 Bellatrix.

The latter was an all-metal low-wing taildragger transport with a retractable undercarriage and a twin-fin tail unit. Powered by a pair of wing-mounted 1,020 h.p. Gnome-Rhône

TAH ARCHIVE

ABOVE ***Developed from the SNCASO SO.90 Casiopée, the Corse twin-engined taildragger was built in two main versions after the war; the ten-passenger SO.93/94 Corse I, of which 15 were built; and the 13-passenger SO.95 Corse II, the 28th production example of which is seen here. A total of 45 Renault 12S-powered Corse IIs was built.***

14N radial engines, the aircraft had a standard range of 2,000km (1,250 miles), a gross weight of 12,138kg (26,765lb) and accommodation for 22 passengers. By the winter of 1942 the prototype, designated SO.30N, had been constructed and was ready for its first flight. The company was barred from undertaking this, however, as a result of the German invasion of southern France. Rather than have the aircraft captured, the SNCASO team, led by Jean-Charles Parot, dismantled it and hid the various components at a remote site in an olive oil factory at Flayosc, near Draguignan in Provence.

Meanwhile, the prototype SO.90 Casiopée, a smaller, more advanced mailplane/transport based on the earlier Bloch MB.800 design, was ready for its first flight by the summer of 1943. On August 16 that year the SNCASO team persuaded the German-Italian Armistice Commission officials at Cannes' Mandelieu airfield to allow chief pilot *Commandant* Maurice Hurel to run up the SO.90's 375 h.p. Béarn engines. The aircraft immediately took off on its unauthorised first flight, carrying nine passengers, and, rather than returning to Mandelieu, the crew flew it across the Mediterranean to the relative safety of Philippeville in Algeria.

The SNCASO team's initiative in hiding the Bellatrix paid off. The Germans failed to discover the aircraft components and, when France's liberation came in August 1944, the parts were recovered and the aircraft was reassembled. Registered F-BALY (later F-WALY), it made a successful first flight on February 26, 1945. While testing continued, the Sud-Ouest team worked on the improved SO.30R (named Bellatrix-A). This had some significant differences, being fitted with a single fin-and-rudder and a retractable tricycle undercarriage. It was powered by more powerful 1,700 h.p. Gnome-Rhône 14R-5 engines and had a higher gross weight of 16,400kg (36,160lb). The

An early production Bretagne at the 1951 Paris Air Salon. The type could be fitted with standard Curtiss Electric four-bladed propellers, as seen here, or three-bladed Hamilton Standard props with square-tipped paddle blades.

JOHN STROUD © A FLYING HISTORY LTD

TAH ARCHIVE

ABOVE ***The second prototype SO.30R, F-WAYB, was initially built with a twin tail, but was fitted with a single fin and rudder when the original Gnome-Rhône piston engines were replaced with a pair of Nene turbojets. After its first flights at Villacoublay in March 1951, it was fitted with soundproofing, air-conditioning and de-icing equipment.***

SO.30R was built at the former Bloch factory at Courbevoie and, registered F-BAYA (later F-WAYA), made its first flight on October 6, 1945, in the hands of test pilot Daniel Rastel.

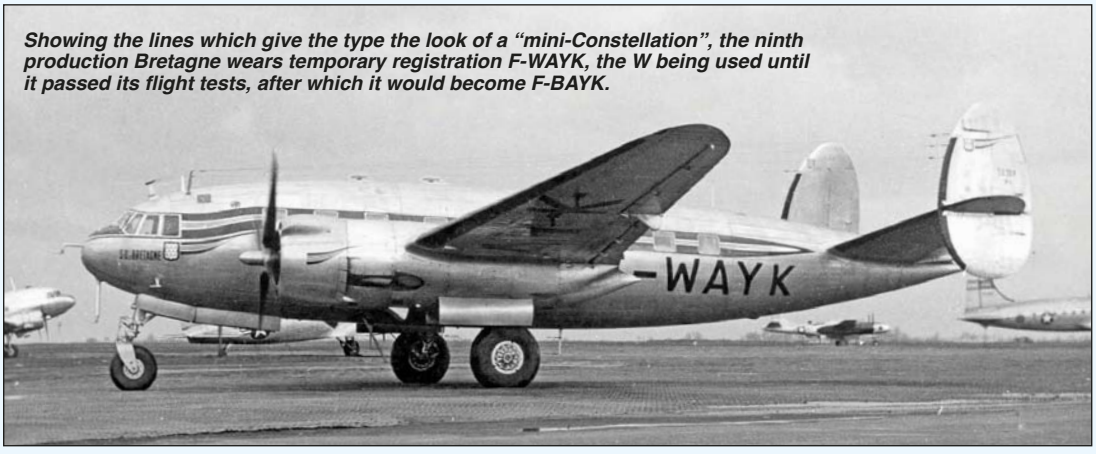
The prototype Bellatrix-A was followed into the air on June 17, 1947, by a second SO.30R (F-WAYB, c/n 02) which reverted to the twin-fin layout of the original SO.30N. This would become the standard tail configuration for the production SO.30P but, because of the greater engine power, the vertical surfaces were larger than those on the original SO.30N prototype and the tailplane was enlarged with tips outboard of the fins.

Following the conclusion of the test programme F-WAYB was rebuilt with a single fin and rudder as an engine testbed. On March 15, 1951, it made its first flight after installation of a pair of Hispano-Suiza-built Rolls-Royce Nene turbojets in place of the standard piston engines. On August 19, 1951, the aircraft achieved the astonishing speed of 700km/h (435 m.p.h.) during the course of extensive testing in the hands of Charles Goujon. It was finally pensioned off at Brétigny in 1954.

Into production

For the production model, designated SO.30P, SNCASO had to make a number of structural changes to meet the new International Civil Aviation Organisation's (ICAO) airworthiness requirements. The name was also altered from Bellatrix to Bretagne.

The first SO.30P-1 (F-WAYC, c/n 1) was manufactured at St Nazaire and made its maiden flight on December 11, 1947. It differed from F-BAYB in having 1,620 h.p. Pratt & Whitney R-2800-B-43 Double Wasp engines, largely because Air France voiced concerns that the type was underpowered and had criticised the take-off performance of the Gnome-Rhône engines. Nine SO.30P-2s were also built, fitted with the more powerful 1,927 h.p.



Showing the lines which give the type the look of a "mini-Constellation", the ninth production Bretagne wears temporary registration F-WAYK, the W being used until it passed its flight tests, after which it would become F-BAYK.

TAH ARCHIVE

MIKE HOOKS COLLECTION

R-2800-CA-18, allowing a higher gross weight.

Internally, the SO.30P had seating for 30 passengers in the "Luxe" version, 34 in the "Comfort" version and 43 in the high-density "Coach" model. It was also envisaged that 16 sleeper berths could be fitted, although there is no evidence that such a version was actually ever produced. In the 30-passenger layout, there was a rear cabin with 15 seats and two forward cabins with nine and six seats, all separated by a central aisle. The main rear cabin door was on the starboard side, rather than the port side as employed on the Douglas DC-3. The cockpit could accommodate up to four crew members including two pilots, a wireless operator and a flight engineer.

With the war at an end, SNCASO actively approached commercial customers. The obvious candidate was Air France, but it had access to ample supplies of cheap Douglas C-47s and showed little interest in the Bretagne. Nevertheless, as a nationalised industry, SNCASO was able to get government approval for an initial production batch. As these came off the line between 1947 and 1949 they were acquired by the Government through the *Direction Technique et Industrielle de l'Aéronautique* (DTIA) and allocated to various national agencies.

The second production aircraft, F-WAYD (c/n 2), was used as an engine testbed with a pair of SNECMA Atar 101 turbojets and was fitted with the single fin and large external underwing fuel tanks, making its first flight in this configuration on January 27, 1953. It continued in service with the *Centre des Essais en Vol* (CEV) until 1963, being used latterly for testing the radar systems for the Dassault Mirage IV.

Bretagne operators

By the time the St Nazaire production line closed in 1955, SNCASO had built another 39 SO.30Ps (c/ns 7–45) and a further four Bretagnes (c/ns 3–6) were not completed. The company also manufactured one example of the SO.30C, which was produced for an *Armée de l'Air* requirement for a military freighter/transport. This aircraft, F-WAYN (c/n 01), made its maiden flight on January 6, 1950, and incorporated belly-mounted

BELOW ***The second production Bretagne, F-WAYD, was also fitted with a single fin and rudder and was used as a testbed for a pair of SNECMA Atar 101 axial-flow turbojets, initially based on Germany's wartime BMW 018 engine. The name Atar derived from the team responsible for its design — Atélier Technique Aéronautique de Rickenbach.***

TAH ARCHIVE

MIKE HOOKS COLLECTION

OPPOSITE PAGE, TOP ***The purposeful and yet elegant shape of the Bretagne, in this case the eighth production example, F-WAYJ, in flight. To demonstrate its confidence in the aircraft, SNCASO flew a Bretagne 600 miles (965km) from Paris to Bordeaux and back on one engine during the 1949 Paris Air Salon.***

RIGHT ***The cockpit of SO.30P-2 F-WEHC. The Bretagne's cockpit layout was snug but orderly, with ample glazing for good visibility. The engineer's controls were located on the starboard side. A panel above the windscreen housed the flap and undercarriage controls.***

freight doors. No order was placed, however, the French military authorities deciding instead to equip with the more versatile Nord Noratlas.

With considerable numbers of production Bretagnes rolling out of the factory, the DTIA and SNCASO were faced with a problem. The aircraft were put out on short leases and loans to Aérocargo, Air France and various government departments, the latter including the French Foreign Office, which had one (F-BAYX, c/n 20) for the use of the French High Commissioner in the Congo. One aircraft, F-BAYQ (c/n 14), went to Iran where it was used by Iranian Airways for services between Tehran and Bombay during the winter of 1950–51. However, the main thrust was with Air Algérie, which operated nine aircraft at various times during 1951–52. The Bretagnes operated alongside a fleet of DC-3s, Air Algérie's network including internal routes from Algiers to Bône (now Annaba) and Philippeville (now Skikda), to Basle and Geneva, and to the French destinations of Paris, Marseilles and Toulouse.

Eventually Air Algérie returned its Bretagnes to DTIA, although F-OAIY (c/n 12) suffered a collapse of its starboard undercarriage leg on take-off from Orly on October 30, 1951, and was destroyed by fire, fortunately without loss of life to the 30 passengers and four crew. Bretagnes were also used by Air Maroc which had been formed through the merger of *Compagnie Chérifienne de Transports Aériens Air Maroc* and Air Atlas. The airline started to receive Bretagnes in 1952 and eventually had a fleet of 12, one of which, F-DABD (c/n 34), was written off at Tangiers in October 1953.

Once their service with Air Algérie and Air Maroc was completed and they were back in France, six of the Bretagnes were passed over to *Aigle Azur* and flown out to French Indo-China, where they flew in the colours of Air Laos during France's long-running conflict in the region. Seven other Bretagnes (including F-OALG to F-OALJ) served in the same theatre with *Société de Transports Aérien Extrême Orient* (STAEO). Not surprisingly, there were casualties during this period and Aigle Azur lost F-OAMA (c/n 14) in an accident at Saigon in April 1954 and F-BEHS (c/n 41) was damaged beyond repair in an

Flying the Bretagne *Flight* report, October 10, 1952

IN OCTOBER 1952 the 25th production Bretagne, SO.30P-2 F-WEHC, was flown to the UK by arrangement with SNCASO's British agent, Aerocontacts Ltd of Gatwick. Weekly magazine *Flight* was on hand to give the French transport the once-over and reported on what it was like to fly:

"In the air the performance and handling qualities seem good. Spring tabs on the rudders, and aero-dynamic balance surfaces, ensure that the rudder and stick forces are not excessive. Effective trimmers enabled the pilot to fly hands-off in level cruise at 170 m.p.h. [275km/h], and in a climb at 160 m.p.h. [257km/h], with the starboard engine off.

"The landing circuit was made at 180 m.p.h. [290km/h] and the tricycle undercarriage was lowered at 160 m.p.h. The landing run was short, even without the additional braking power from the reversible-pitch Hamilton Standard propellers."

The *Flight* report concluded that "the aircraft possesses, but does not markedly exceed, the general performance characteristics of British and American types of similar size and power."

TAH ARCHIVE

JOHN STROUD © AFLYING HISTORY LTD

ABOVE ***One of the few commercial operators to use the Bretagne extensively was Air Algérie, which operated nine examples during 1951–52. This example has been fitted with a pair of Turboméca Palas centrifugal-flow turbojet engines to improve take-off performance.***

LEFT ***This view of F-WEHC shows the revised cowling arrangement of the Pratt & Whitney Double Wasp engines on the SO.30P-2, which sported simplified top and bottom intakes, in contrast to the "chin" and "eye" positions for the oil cooler and carburettor on the SO.30P-1, as seen on the Air Algérie example above.***

BELOW ***Bretagne in uniform — following its brief career as an airliner, the type was put into service with the French military, operating with the Aéronavale and the Armée de l'Air, as well as Government agencies. The 37th production example is seen here at Blackbushe in 1959.***

MIKE HOOKS

SNCASO SO.30P Bretagne data

Powerplant

SO.30P-1 2 x 1,620 h.p. Pratt & Whitney R-2800-B43 Double Wasp twin-row 18-cylinder air-cooled radial piston engines

SO.30P-2 2 x 1,927 h.p. Pratt & Whitney R-2800-CA18 Double Wasps

Dimensions

Span	26·90m	(88ft 2in)
Length	18·95m	(62ft 2in)
Height	5·90m	(19ft 4in)
Wing area	85m²	(925ft²)

Weights

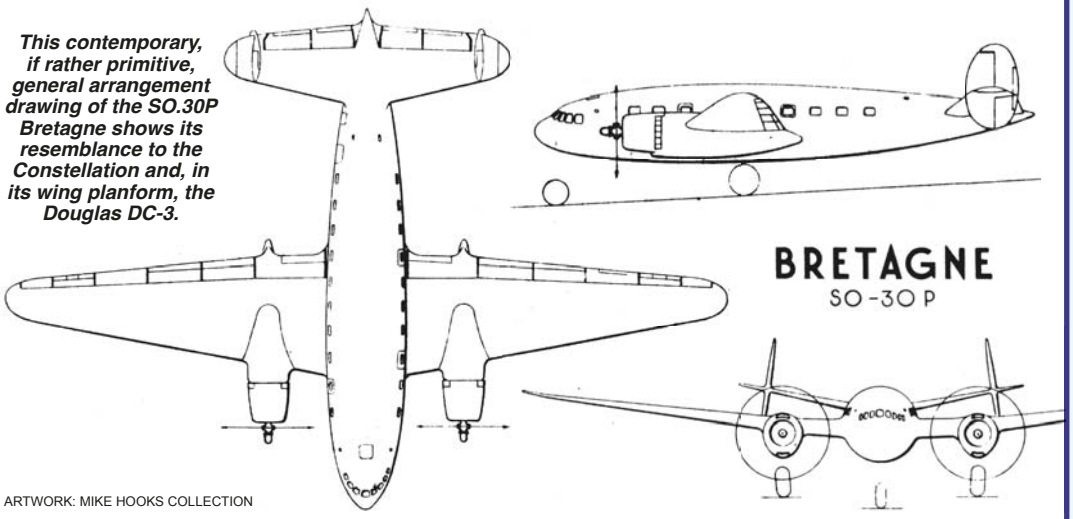
Empty	13,450kg	(29,590lb)
Useful load	5,050kg	(11,100lb)
Maximum take-off	18,500kg	(40,700lb)

Performance*

Max speed	575km/h	(357 m.p.h.)
Cruise speed at 6,000m (19, 680ft)	415km/h	(258 m.p.h.)
Take-off run	1,060m	(3,480ft)
Range with max fuel	2,920km	(1,810 miles)

* SO.30P-1 data

This contemporary, if rather primitive, general arrangement drawing of the SO.30P Bretagne shows its resemblance to the Constellation and, in its wing planform, the Douglas DC-3.



ARTWORK: MIKE HOOKS COLLECTION

emergency landing at Hanoi on August 30, 1954.

Eventually, with no obvious commercial future in sight, the majority of the Bretagnes ended up with the *Aéronautique Navale*, which had 18, serving with Escadrilles 4.S, 5.S, 31.S and 32.S, and the Armée de l'Air, which operated six from Villacoublay, outside Paris. Apparently some of the naval aircraft were used for towing targets for ships' gunnery practice and some were fitted with a pair of auxiliary Turboméca Palas turbojets under the wings to aid hot-and-high take-off performance. A further two SO.30Ps were delivered to the Presidential Flight as VIP aircraft, being named *France* (No 24) and *Anjou* (No 25). In addition to the standard military aircraft, another five were allocated to the CEV for general communications work and for some testing of engines and avionics.

Le départ

By 1971 the last Bretagnes had been withdrawn from service and scrapped. A few were positioned at airfields such as La Roche-sur-Yon as gate guardians and some were allocated to museums for preservation. Two Bretagnes — No 19, formerly F-BAYV from La Roche-sur-Yon, and No 22, formerly F-BAYZ — were taken to Ambérieau-en-Bugey in the Loire Valley and joined together to create a restaurant, the Grill-Avia, sadly later destroyed by fire. There is now just one Bretagne survivor; No 37, which had been used at the CEV at Brétigny and later at Istres and is now in the hands of the *Association Je Me Souviens* at St Nazaire undergoing restoration.

In the event, the company produced just four prototypes and 41 production SO.30Ps. As for the final verdict on the Bretagne, it must be that it was essentially a competent aircraft which delivered on most of the demands made of it. Indeed, SNCASO was not the only manufacturer that failed to realise the impact of war-surplus transports on the limited post-war market. It is significant that the French Air Force and Navy operated more than 260 DC-3/C-47s which, thanks to their good economics, ease of operation and plentiful supplies of spares, continued in operation until more than a decade after the Bretagnes had gone out of service.

One of the first batch of eight BAe Hawk Mk 60s for the Air Force of Zimbabwe (AFZ) overflies Victoria Falls on the Zimbabwe/Zambia border after their delivery in 1982. The Mk 60 was an upgraded version of the Hawk Mk 50 export variant, essentially a trainer, but with a potent ground-attack capability.
BAE SYSTEMS VIA AUTHOR

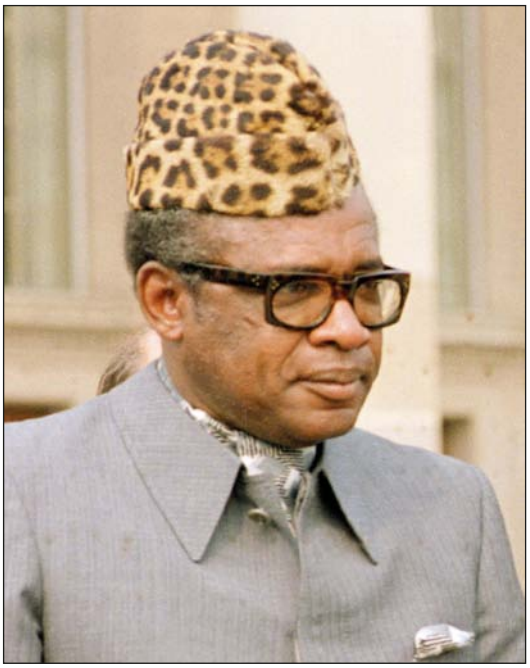
THE HAWK'S FINEST HOUR

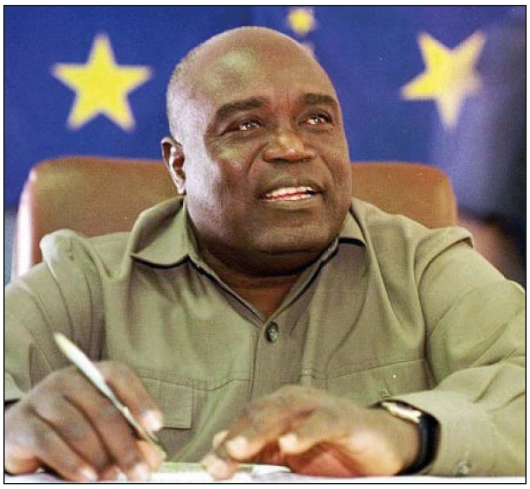
TOM COOPER gathers slowly-emerging details of the Air Force of Zimbabwe's deployment to the war-torn Democratic Republic of Congo in 1998 to reveal the crucial role played by Zimbabwean air support in the midst of a Central African power struggle, culminating in the extraordinary siege of Kinshasa's N'djili Airport

OUR STORY BEGINS back in the mid-1990s, when one of the many simmering rebellions in eastern Zaïre developed into a major war. This was during the regime of the late dictator Joseph Mobutu, who was facing the Alliance of Democratic Forces for the Liberation of Congo (ADFL), a group of rebels led by Laurent-Desiré Kabila, once a small-time Marxist, and supported by Rwandan strongman and Defence Minister Maj-Gen Paul Kagame.

In the late summer of 1996 Kagame despatched one of his most capable commanders, James Kabarebe, and several battalions of the regular Rwandan Patriotic Army (RPA) to lead an ADFL advance from eastern Zaïre to the capital, Kinshasa, in the west of the country. Within two months, most of the country east of the Congo river was under RPA control.

Preferring to wish the war away, Mobutu and his aides





LEFT ***Wearing his trademark leopardskin hat, Joseph Mobutu (aka Mobutu Sese Seko) is seen here during a visit to the USA in 1983. Mobutu was President of the Democratic Republic of Congo (which he renamed Zaïre in 1971) from 1965 to 1997, when he was deposed by Laurent-Desiré Kabila,*** **ABOVE.** ***Kabila managed to stay in power until his assassination in January 2001.***

were slow to react. A half-hearted attempt to recruit a number of French, Belgian and Serbian mercenaries, launched in the late autumn of 1996, proved a short-lived adventure of dubious character. On the ground the French and Belgians were more than a match for the rebels, but their numbers were insufficient. The Serbs were to fly fixed- and rotary-winged aircraft purchased to provide close air support, take care of supplies, secure two airfields used as bases and train Zaïrian troops. This *Légion Blanc*, as it became known, was to be equipped with a total of six MiG-21s, three Soko J-21 Jastrebs and one G-2 Galeb, a Pilatus PC-6B Turbo Porter and a Hawker Siddeley Andover transport, as well as at least four Mil Mi-24 *Hind* helicopter gunships reportedly acquired from Ukraine via France.

The history of this "air force" was extremely short. Although all the aircraft and helicopters were delivered to Gbadolite airport in northern Zaïre, the MiGs were never fully assembled, while the Jastrebs and the Galeb light ground-attack aircraft saw only limited service. One of the Jastrebs was destroyed when Serbian pilot Col Ratko Turĉinović made an ultra-low-level pass over the airfield. Hungover from the night before, Turĉinović clipped a lamppost with a wing; his Jastreb fell into a column of Zaïrian troops, killing dozens. The PC-6B and one of the Mi-24s were also destroyed in accidents. The Serbs proved useless and were sent back home within a few weeks; the French and Belgians soon followed.

Mobutu's rule survived only a few months more. After delivering a "last stand", the majority of his army joined the rebels and on May 15, 1997, the dictator fled Kinshasa to Gbadolite, from where he left the country aboard an Ilyushin Il-76 transport, chartered from notorious Russian-Tajik arms dealer Victor Bout.

THE MASTER PLAN

The country that Kabila took over was in poor condition. The civilian and security infrastructure had collapsed, communications were almost non-existent, industry was ravaged and the economy was in ruins. Officially declared President of the newly named Democratic Republic of Congo (DRC), Kabila ruled a territory that was in fact confined to a few major towns, most of which were not held by his ADFL fighters, but by Rwandan and Ugandan troops. The new ruler was relying on Kigali (the Rwandan capital) and Kampala (capital of Uganda) for political and military control, while lacking a solid political base at home and with no interest in power-sharing. When Kabila's actions began to turn popular opinion against the ADFL, the alliance fell apart and his former aides began plotting his downfall.

The Rwandans and Ugandans were dissatisfied too; they had expected the new President to give them control not only of the immense refugee camps in the east of the country, but, importantly, of the rich mineral resources of the east. The Rwandans and Ugandans began searching for a reason to act. It was provided by Kabila himself on July 27, 1998, when he issued an official order for all Rwandan and Ugandan military personnel to leave the country immediately, citing a failed assassination attempt against him, along with the RPA's genocide of Hutu refugees, as the reason.

The reaction was not long in coming. On August 2, 1998, several thousand troops of the

LEFT ***A map by MAGGIE NELSON showing the major locations of the fast-moving Congo wars of the 1990s, the so-called First Congo War taking place between October 1996 and May 1997, the much longer Second Congo War beginning in August 1998 and continuing until 2003.***

BELOW ***Two of the four MiG-21PFMs delivered from Serbia to DRC for Mobutu's forces in 1997, seen here abandoned at Gbadolite. In 2001 South African mercenaries were contracted by Kabila to make the aircraft operational, but the idea came to nothing.***

10th Brigade of the *Forces Armées Congolaise* (Congolese Army — FAC) mutinied in Goma. Most of these previously privileged soldiers were Banyamulenges — members of the Tutsi ethnic group that fell with Mobutu and depended on Rwandan protection for survival, even under Kabila. When the mutineers were confronted by loyal troops, fierce fighting broke out, resulting in the destruction and looting of a large section of Goma. The mutiny spread around the country, with garrisons in Uvira and Bukavu swiftly joining the rebels and Rwandan troops.

The media presented the origin of the ensuing conflict as a mutiny of the Congolese military, followed by the rebellion of elements within the ADFL against Kabila's rule — in effect, a civil war. To all intents and purposes, however, the war had now turned into an all-out conflict involving around a dozen African nations.

From the beginning of what is often referred to as the Second Congo War, Rwandan and Ugandan troops played a crucial role in the attempt to remove Kabila from power. Goma airport was overrun by Rwandan special forces on August 2, 1998, resulting in the commandeering of several airliners owned by *Lignes Aériennes Congolaises* (Congolese Airlines — LAC), a Congo Air Cargo Boeing 707 and a Blue Airlines Boeing 727. These were used to fly in additional RPA troops from Kigali, before being prepared for the next part of the Rwandan plan.

Rwandan Defence Minister Kagame had two influential aides in western DRC in the form of Bizima Karaha and Déogratias Bugera. Both former ministers of Kabila's government, they used their influence to secure control of Kitona Air Base, a huge military airfield on the Atlantic coast, with the help of officers and soldiers opposed to the new president. Kagame intended to use commandeered passenger aircraft to deploy a full RPA brigade to Kitona, from where a bold rebel attack could be made on Kinshasa.

JAMES MOOR VIA AUTHOR

VIA AUTHOR

ABOVE ***The best of British — Hawk "606" of the first batch of Hawk Mk 60s delivered to the AFZ flies alongside the type it replaced in service, in this case Hawker Hunter "1801", formerly FGA.80A "804" of the Kenyan Air Force. Before Kenyan service this Squires Gate-built Hunter had served with the RAF's Nos 3 and 26 Sqns as F.4 XF972.***

The Rwandan air bridge was put into effect on August 4, 1998, with eight flights between Goma and Kitona being recorded by the Congolese authorities. After their arrival at Kitona, Rwandan troops, joined by a brigade of rebels, moved towards the nearby coastal town of Muanda. In their wake, commandeered airliners were then used to fly in a battalion of Ugandan special forces. Within a matter of days the rebel forces were approaching the strategically important port of Matadi, threatening to cut off the sole supply line to Kinshasa. Convinced of success and supported by supply lines from the immense depots at Kitona, James Kabarebe planned to reach Kinshasa's N'djili International Airport by August 19, after which he was convinced that the capital would collapse "automatically".

Kabarebe deployed his troops using infiltration tactics, which had proved remarkably effective during the uprising against Mobutu. A battalion of troops would rush ahead of the main force, at which point the forward force would disguise itself as civilians, gather at a predetermined position and attack from the rear. The occupation of local airfields was the first priority, enabling reinforcements and supplies to be flown in. This would often engender panic on the part of defenders, and the defence of most garrisons collapsed within a few hours.

On August 4, 1998, Kabila signed a treaty with Robert Mugabe's Zimbabwe, beyond Zambia to the south, and neighbouring Angola. The two countries were to provide military aid in exchange for concessions on Congolese mineral resources. An advance party of the Zimbabwean Defence Forces (ZDF) arrived in Kinshasa on August 8, its task being to monitor the departure of Rwandan and Ugandan troops from the country.

ZIMBABWE ENTERS THE FRAY

Within two days of its preliminary report about the situation in DRC, the ZDF launched Operation *Sovereignty Legitimacy*. Using Il-76 transports chartered in Russia and the Ukraine, as well as Air Zaïre passenger aircraft, a major deployment of Zimbabwean troops to N'djili Airport at Kinshasa began. By August 12 more than 800 ZDF soldiers — including Special Air Service troops — were in place.

As the rebels continued their advance on the capital and tension in Kinshasa increased, a decision was taken to bring air power into the equation. In 1998 the Air Force of Zimbabwe (AFZ) was not in the best position to fight a war, operating relatively old aircraft and experiencing acute spares-acquisition problems. However, the Zimbabweans were old hands at surviving against the odds. Indeed, the AFZ's Air Marshal Perence Shiri — with AVM Ian Harvey as Chief of Staff, Operations, and AVM Henry Muchena as Chief-of-Staff, Supporting Services — was in command of the most competent military flying service in sub-Saharan Africa. The AFZ was a well-trained, experienced air arm with motivated personnel that prided itself on its excellent flying safety record and high standards of operation.

TAH ARCHIVE

ABOVE ***The first of the Zimbabwean Mk 60s, "600", during a photographic sortie from BAe's airfield at Dunsfold. In common with the Mk 50, the Mk 60 could be optimised for the air-support role, as seen here with the fitting of four 250kg free-fall bombs on each wing, two on each hardpoint, and the centreline-mounted Aden 30mm cannon.***

In August 1998 the AFZ consisted of eight flying units; No 1 Sqn operated five ex-Kenyan Hawker Hunter FGA.9s (out of 12 delivered), one Hunter FGA.9 left over from the former Rhodesian Air Force and a single two-seat ex-Kenyan Hunter T.81. None of these was operational, however, and no Hunters would be deployed to DRC for the upcoming conflict.

The AFZ's No 2 Sqn comprised ten BAe Hawk Mk 60/60As (of 13 supplied in two batches; eight Mk 60s in 1982 and five Mk 60As in 1992), while two airframes were stored. The Hawks were used as strike-fighters, equipped with Mk 82-series bombs (or similar locally-manufactured weapons) and Hunting BL755 cluster-bomb units (CBUs), as well as launchers for unguided rockets. As originally delivered to Zimbabwe, the type was wired to carry American AIM-9B Sidewinder air-to-air missiles, but the AFZ later installed Chinese-made PL-5 and PL-7 missiles, essentially copies of the French Matra R.550 Magic.

Operating 12 CASA C.212-200s and five Britten-Norman BN-2A Islanders, No 3 Sqn formed the backbone of the AFZ's transport fleet. Transport and liaison duties were also undertaken by No 7 Sqn, which was equipped with Aérospatiale SA.316B Alouette IIIs (including 19 ex-Portuguese Air Force examples), and No 8 Sqn, equipped with eight Agusta-Bell 412SPs.

A total of seven Chengdu F-7II/IIN interceptors and two Guizhou FT-7BZ trainers was operated by No 5 Sqn at Thornhill, near Gweru in Zimbabwe. The final two AFZ units, Nos 4 and 6 Sqns, were equipped with 15 Reims-Cessna FTB 337Gs, known as Lynxes in AFZ service, and 27 SIAI-Marchetti SF.260 Genets (Warriors) of different

Reims-Cessna FTB 337G Lynx "3144" of the AFZ was one of several that participated in the early days of the Second Congo War and the battle for Kinshasa. Operated by No 4 Sqn, the Lynxes primarily used Matra F2 rocket pods and overwing-mounted M2 Browning machine-guns, as seen here. Artwork by TOM COOPER © 2015.

VIA AUTHOR

KATSUHIKO TOKUNAGA / DACT VIA AUTHOR

LEFT ***One of the Hawk pilots who took part in the AFZ's campaign in DRC in 1998, Brian Chikozo, prepares for a low-level ground-attack sortie. ABOVE Several of the Hawks used in DRC sported names and artwork; Hawk "610", for example, was known as*** **Darth Vader**, ***after the character from the*** **Star Wars** ***movies. Similarly, Hawk "605" was adorned with a stylised cobra in approximately the same location on the forward fuselage.***

sub-variants, including SF.260Ms, TPs and Ws. Six additional SF.260s were ordered from Italy in 1997, with delivery slated for the late summer of 1998, but it remains unclear whether any of these ultimately reached Zimbabwe.

On August 19, 1998, all AFZ operational units were placed on alert. Barely 24 hours later the first aircraft were on their way to Kinshasa. The first to go were the slower Cessna 337 Lynxes, followed by a cadre of Hawks on August 21. At the same time, Alouette IIIs of No 7 Sqn and AB 412s of No 8 Sqn were airlifted to DRC. The latter type proved unsuitable for transport aboard the chartered Il-76s, and all four airframes had to be dismantled before loading. Other aircraft involved in the airlift were C.212 transports and a number of aircraft owned by local carriers, including several Douglas DC-3s. These aircraft were mainly used for transport of troops and materiel. On August 21 another four Hawks were flown directly from Thornhill to N'djili.

ADVANCE ON KINSHASA

As Zimbabwean troops poured into N'djili, the RPA, along with rebel forces and Ugandan special troops, continued their advance, capturing the port of Matadi on August 13. Seven days later a rebel battalion, led by Dieudonné Kabengele, captured Mbanza-Ngungu, some 75 miles (120km) south-west of Kinshasa. So far, Kabarebe's plan was on schedule.

By 1400hr on August 22, four Hawks were ready at N'djili. As No 2 Sqn was also the AFZ's Jet Flying Training School, all pilots qualified to fly No 5 Sqn's F-7s and FT-7s were dual-trained on the Hawk. Thus when the order came for No 2 Sqn to deploy to DRC, the detachment drew a number of highly-experienced F-7 pilots, including Flt Lts Ncube, Brooks, Enslin and Jaya.

Barely minutes after arriving, the unit was scrambled to fly a series of strikes against enemy positions at Celo-Zongo. As soon as the Hawks returned, they were swiftly turned around. The speed of operations was such that medics and caterers were pushing bombs and ammo boxes to the aircraft. More air strikes were flown during the afternoon, and in the evening the rebels — the advance party of which was at Kisantu, only 60 miles (100km) south-west of Kinshasa — claimed to have shot down two "Zimbabwean MiGs".

The AFZ actually suffered no losses during the fight for Kinshasa. Not expecting to encounter air power in DRC, the Rwandan, Ugandan and rebel forces failed to arm their troops with effective anti-aircraft weapons, especially man-portable air-defence systems, or MANPADS. Instead of wreaking havoc on AFZ aircraft, the rebel forces began suffering from strikes flown by Zimbabwean Hawks and Lynxes.

The lack of MANPADS was to cost the rebels and Rwandans dearly on August 24, when an AFZ Lynx on a reconnaissance mission located and attacked an armoured column of T-55 and Type-69 tanks near Kasangulu, barely 25 miles (40km) south-west of Kinshasa. After reporting his target, the pilot attacked, firing 68mm unguided rocket projectiles from his Matra F2 pods, destroying one of the tanks. The timely report enabled the ZDF to redeploy its forces: the tank column was subsequently ambushed by Zimbabwean Paras. A number of tanks were destroyed by RPG-7s and the rest were captured.

While the Zimbabwean ambush stopped one prong of the Rwandan advance, the crisis was not yet over. Kabarebe rescheduled his plan, deploying additional units to bypass forward Zimbabwean positions, with the aim of reaching his original target, N'djili, by August 26. On

AFZ VIA AUTHOR

LEFT ***A poor-quality but rare photograph of the crew of one of the Agusta-Bell AB 412s used by the AFZ's No 8 Sqn in DRC. The helicopters were used mainly for casualty evacuation and resupply sorties during the battle for Kinshasa and during fighting at Kongolo in 1999.***

BELOW ***Hawk "604" in Zimbabwe in 1997. In 1994 the simple golden bird motif on the fin of the AFZ's Hawks was replaced with the national flag, and a roundel featuring the national colours in concentric rings was introduced on the fuselage and wings.***

their way towards Kinshasa, the rebel forces hijacked trains and civilian trucks, while some of their units marched. They knew that the ZDF's advance force was numerically inferior and could not hold a wide front. The rebels needed N'djili Airport in order to be able to airlift supplies and reinforcements from Goma and thus facilitate the advance into Kinshasa. Their expectation was that an advance deep behind the enemy lines, accompanied by a strike directly at the enemy's nerve centre, would force the ZDF units south of Kinshasa to collapse. The resulting battle for N'djili was thus decisive for the outcome of the battle for Kinshasa.

THE SIEGE OF N'DJILI

Lacking numbers and being unable to establish a coherent front to tackle the Rwandans' typical infiltration tactics, and with the latter on the verge of finding a way into Kinshasa, the commander of the Zimbabwean ground forces, Maj-Gen Mike Nyambuya, reacted with a flexible deployment. On the morning of August 25 his special forces fanned out to establish several blocking positions some 25 miles (40km) outside the city. Although outnumbered and operating in unfamiliar terrain, the special forces ambushed a number of convoys, causing significant losses to the Rwandans and destroying several rebel bases. Simultaneously, AFZ aircraft heavily damaged a train hijacked by the rebels and hit several enemy columns. These efforts were insufficient, however, as Kabarebe continued to pour units into the battle at several points simultaneously, thereby outflanking the Zimbabwean forces.

During his advance on Kinshasa, Kabarebe usually had a Rwandan or Ugandan battalion in the vanguard; for the final blow against N'djili, however, he changed tactics and put a rebel battalion up front instead. On the morning of August 26, disguised as retreating FAC troops, the rebel battalion bypassed forward Zimbabwean

MILPIX VIA AUTHOR

KATSUHIKO TOKUNAGA / DACT VIA AUTHOR

ABOVE ***Hawk "605" sported a cobra motif beneath the cockpit and was one of No 2 Sqn's most active Hawks during the 1998 DRC campaign. The Mk 60 variant introduced the uprated Rolls-Royce/Turbomeca Adour 861 engine, which provided significantly more thrust, increasing maximum take-off weight to 18,960lb (8,600kg).***

positions and was reported to be only a couple of miles from Kinshasa and heading for N'djili.

The plan nearly worked. The first wave of 300 rebels was identified while less than 110yd (100m) from the main terminal. They were cut down by the alert crew of a ZDF Cascavel armoured personnel carrier parked nearby. The following wave, however, managed to occupy positions along the western threshold. Within minutes the third wave, made up of Rwandans, had reached the main terminal and control tower.

While Kabila was shocked by the appearance of several sizeable enemy task forces so close to the capital, the speed and size of the attack did not come as a surprise to the Zimbabweans. Thanks to the activities of the Zimbabwean special forces and AFZ aircraft, Air Marshal Shiri and Maj-Gen Nyambuya had been tracking the enemy's advance for days. When the Rwandans appeared at N'djili, the Zimbabwean forces were ready. All aircraft had been refuelled and armed the previous night, and the first strikes were launched at 0500hr that morning. Within minutes, all available assets were involved in the fight to halt the enemy assault on the airport.

Intensive operations continued over the course of the day, although the fighting on the ground subsided in the torrid heat of the Congolese noon. Zimbabwean crews at N'djili continued launching one aircraft after another.

As well as performing ground-attack sorties, the Zimbabweans also evacuated Kabila from Kinshasa. He was picked up from the Presidential Palace by Zimbabwean SAS operatives in two Alouettes on the afternoon of August 26, and evacuated to N'djili Airport, from where he was flown to Lubumbashi in the presidential jet. Meanwhile, the loyal Congolese military — mainly "Katangan Tigers" from the south-eastern DRC — worked hard as well. Convoys of mechanised units were swiftly pushed through the city. Tanks and armoured personnel carriers set up roadblocks in southern Kinshasa.

Despite these reinforcements, the rebels captured a road bridge connecting N'djili with Kinshasa in the early hours of August 27. As a result the ZDF was unable to bring supplies and reinforcements into or from the capital. The Zimbabweans now had to rely solely on aircraft coming in from Zimbabwe.

One of two Mil Mi-24* Hind *gunship helicopters left behind by the Mobutu regime and made operational during the battle for Kinshasa, 9T-HM2 was equipped with the standard 14·5mm machine-gun in a nose-mounted rotating barbette. Artwork by TOM COOPER © 2015.

JOHN REID-ROWLAND VIA AUTHOR

ABOVE ***In the wake of the battle for Kinshasa, a Flight of the AFZ's No 8 Sqn, under the command of South African Sqn Ldr Dave Atkinson, was re-equipped with six Mi-35 helicopter gunships. Funded by Kabila's supporters, these were acquired from Russia for a reported $26·35m. The first Mi-35 crews were trained by Russians at Thornhill.***

Several times during the day the rebels reached the airport's westernmost buildings and held the western side of the runway. The AFZ continued to launch air strikes, most of which were executed with surgical precision; enemy positions were very close to friendly forces, and pinpoint accuracy by the pilots was vital.

TAKE OFF, DROP BOMBS, LAND . . .

Within two days AFZ Hawks and Lynxes had flown more than 100 combat sorties, dropping numerous loads of napalm and cluster bombs and firing thousands of rockets and 30mm shells at enemy troops dug in around N'djili. The tempo of operations was so high that one Lynx and three helicopters came up for primary servicing at the same time. The AFZ technicians completed work on all four aircraft by the following morning.

The only external support the AFZ used was a South African mercenary, who flew two Mil Mi-24 *Hind* helicopter gunships left over from the Mobutu regime. The first, serialled 9T-HM1, was an Mi-24P, equipped with a Gryazev-Shipunov GSh-30-2 dual-barrelled autocannon; the second, 9T-HM2, was an Mi-24V equipped with a standard 14·5mm heavy machine-gun in a rotating barbette. Given that the South African was the only available pilot qualified on the *Hind*, these helicopter gunships were always operated singly. The fighting was so fierce that both were damaged and forced to land, after which they were repaired by Zimbabwean technicians.

Aside from the two *Hinds*, AFZ technicians also found three ex-Zaïrian Air Force Aermacchi MB-326Ks at N'djili, one of which was made operational and flown on a sortie by a Congolese pilot, along with four Hawks. The Congolese pilot separated from the formation, however, and failed to find his target, eventually landing with his wheels up, severely damaging the aircraft. Also made operational were two of three SF.260s found by the Zimbabweans at the airport. These were flown by Congolese and AFZ pilots on reconnaissance missions. One of the SF.260s crashed in Celo-Zongo, 85 miles (140km) south of Kinshasa, in bad weather. It was recovered by a group of 11 AFZ technicians, led by Sqn Ldr Ranga, with the support of ZDF troops.

Zimbabwean veterans of the Second Congo War have little doubt that it was the AFZ's Hawks that won the day. Despite the fact that parts of the N'djili Airport complex were repeatedly captured, lost and recaptured by the Rwandans and rebels, the AFZ's assets remained operational. Kabarebe had failed to recognise the significance of an important detail — the 15,420ft (4,700m)-long runway at N'djili. Although the enemy temporarily controlled the western approach to the runway, the Zimbabweans could still take off and land in, or from, an easterly direction.

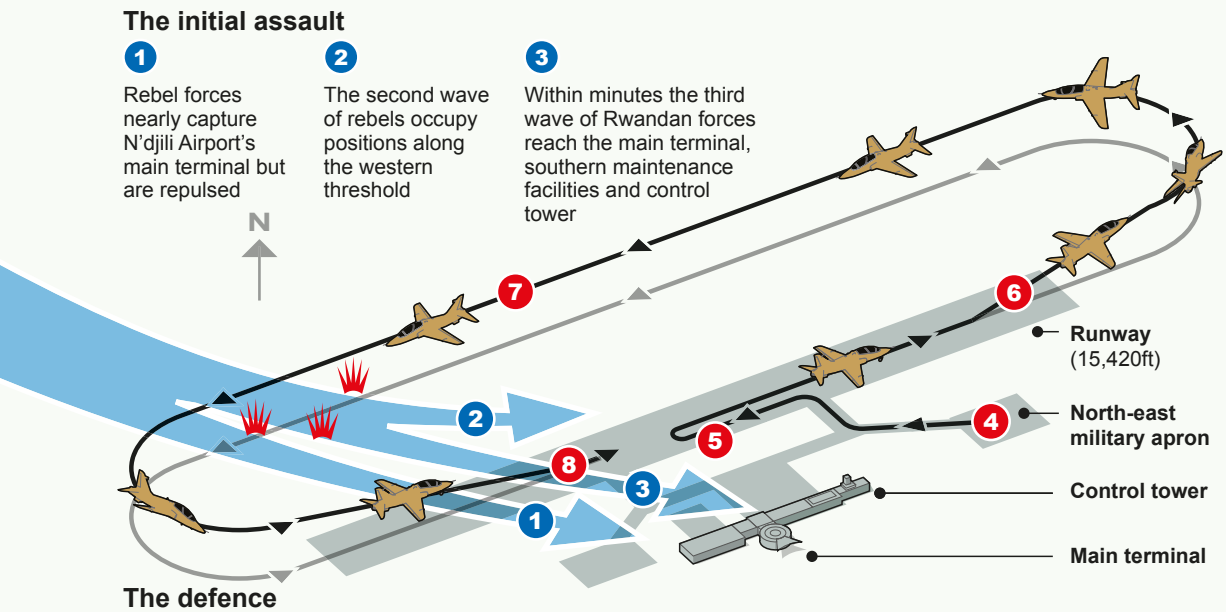
The AFZ aircraft were based on the north-east military apron, some 1¾ miles (3km) from the main battlefield. There they could be safely armed, fuelled and sent into combat. The pilots would roll south-west down the runway before making a 180° turn to take off to the north-east. Once airborne, they would make another 180° turn to port to bomb, rocket and strafe enemy positions on the opposite side of the airfield. Many of the strikes were flown with the jets accelerating to flying speed having turned downwind at low level over the River Congo to the north of the airport. Owing to the proximity of the enemy, the aircraft did not need to refuel between sorties.

The Zimbabwean pilots put their mounts through their paces, experiencing what they describe as "the Hawk's finest hour, and the type's most successful deployment ever". Their

ABOVE ***Two of the first batch of Hawk Mk 60s for Zimbabwe, the nearest carrying a ground-attack configuration of eight free-fall 250kg bombs and the Aden cannon, and the furthest being equipped for long-range interception sorties with droptanks and air-to-air missiles.*** **BELOW** ***The view from the "office" of a ground-attack Hawk Mk 60.***

TAH ARCHIVE x 2

The Siege of N'djili Airport: August 26-29, 1998



Graphic: Ian Bott *www.ianbottillustration.co.uk*

targets were so close that most of the sorties lasted 10min or less. The aircraft could be loaded to maximum capacity with bombs, rockets and gun ammunition, and most pilots flew as many as four or five attacks a day.

The AFZ technicians produced one miracle after another. Aircraft were generally turned around within 5min, although, inevitably, technical snags occurred as a result of such intensive usage. Servicing was undertaken overnight, with the hardworking technicians grabbing rest well after midnight. Before finishing operations for the day, team leaders would report back to Harare which spares were required, and these would be delivered within hours. No AFZ aircraft became unserviceable owing to a lack of spares.

There were other problems, however, including safety issues, as the Congolese military had been heavily infiltrated by the enemy. The AFZ's Gp Capt Biltim Chingono worked hard to coordinate all the available flying assets with Congolese officers, while keeping an eye on the security of military secrets.

Most of the fighting during August 28–29 occurred at dawn and dusk. Under repeated massive attacks by a numerically superior enemy, the Zimbabweans were on the verge of defeat. Zimbabwean Special Forces — SAS operators, the Parachute Battalion and a Commando Group — with extensive support from AFZ Hawks, Lynxes and helicopters, nevertheless held off and routed a combined force of regular Rwandan and Ugandan troops and Congolese irregulars. On the ground, the ZDF Paras claimed a kill ratio of 26:1 in their favour.

The situation in southern Kinshasa was stabilised only when the two Rwandan battalions were decimated during their last attacks on the early morning of August 29. Out of ammunition and supplies, the Ugandans and rebels were also unable to continue the onslaught. In the late afternoon of the same day, the fighting reached its next spike when the Zimbabweans launched their first counter-attacks, engaging Rwandans, Ugandans and rebels in trench warfare south of N'djili, before heading for the built-up areas of Kasangani, the slum around the western side of the airport (not to be confused with Kisangani).

Hawk "608" was another example much used in the DRC in 1998, and is seen here with a selection of the weaponry used in the campaign. From left: Matra F2 rocket pod (each containing six 68mm rocket projectiles); Matra 116M rocket pod; Matra F4 rocket pod (both containing 19 x 68mm rocket projectiles); 250kg Mini Golf cluster bomb. Fitted to the Hawk's wing is the larger 454kg Golf cluster bomb. Artwork by TOM COOPER © 2015.

By the morning of August 30, the two Rwandan battalions were neutralised and had to be pulled out of the battle. Rebel units replacing them could not hold their ground. Realising that their Rwandan allies were not invincible, as initially believed, they began surrendering in large numbers. Kabarebe then ordered some of his troops to cross the Congo River north into Congo-Brazzaville (Republic of the Congo), while the main body fled south to northern Angola.

"ZIMBABWEAN MIGS"?

In August 1998 the Congolese rebels and Rwandans issued some 30 claims to have shot down aircraft during the fighting, types including a "Zimbabwean MiG", "Mi-17 jet fighter", "Mil-3", "M-135 gunship", "South African Mirage F1", and even a "USAF B-52 bomber"! Despite flying hundreds of sorties during the battle for Kinshasa, the AFZ in fact suffered only minimal losses. Although many were hit by small-arms fire, not a single AFZ aircraft was downed during the fight for control of the capital.

There were AFZ losses in the aftermath, however. The first occurred during "mopping-up" operations in the Celo-Zongo area on September 4, 1998, when a Congolese SF.260, flown by AFZ Sqn Ldr Sharunga, was shot down by one of the first MANPADS the Rwandans deployed in western Congo, killing the pilot. The next loss occurred on December 14, 1998, when a cannon-armed Alouette III "K-Car", flown by Sqn Ldr Vundla and carrying Col Kufa, was shot down, with both officers killed. The third crewmember, gunner Flt Lt Sande, was captured by the rebels.

The most high-profile AFZ loss occurred on March 23, 1999, during the next round of the conflict, at Kongolo in the central eastern part of DRC. The rebels, supported by two Rwandan brigades equipped with Soviet-designed and -built BM-21 Grad multiple-rocket-launchers and other artillery, crossed the River Congo north and south of the town, taking the local Congolese garrison by surprise and causing some 2,000 inexperienced troops to flee the battlefield, thus leaving a ZDF battalion deployed near Kitanda in an isolated position. The Zimbabweans fought back with determination, attempting to keep a six-mile (10km) stretch of road open, but eventually had to give up in the face of a numerically superior enemy, losing seven soldiers in the process. The battalion thus found itself surrounded in thick jungle deep behind enemy lines.

The AFZ supported the unit with intensive strikes flown by Hawks and a newly-delivered batch of Mi-35 *Hind* gunships, inflicting very heavy casualties on the northern prong of the enemy advance. Alouette III and AB 412 helicopters also flew re-supply and casualty-evacuation missions, but the area soon became too "hot" for them to continue.

When a pair of Hawks dive-bombed an enemy position near Kakuyu, a missile passed between the jets. The lead recovered to low level, but two missiles were then fired at the second Hawk. The first passed over, but the second hit the tail. The pilot, Flt Lt Michael Enslin, ejected but injured his leg in the process. He landed behind enemy lines, beginning a three-week journey back to the Zimbabwean battalion. During his evasion, with Rwandans and rebels in hot pursuit, Enslin was unable to make contact with any of the local population, as the area was devoid of villagers owing to the atrocities and intimidation wrought

AFZ VIA AUTHOR

LEFT ***Flight Lieutenants Michael Enslin (left) and Sam Sigauke pose beside Hawk "605" in 2000. Enslin had just won the AFZ's prestigious "Jungle Dustbin Marksmanship Trophy", having fully recovered from his ejection and evasion from enemy forces in DRC in 1998. He went on to fly Chengdu F-7s with No 5 Sqn.***

BELOW ***The Hawk proved its impressive ground-attack possibilities in AFZ hands during the battle for Kinshasa, but economic sanctions placed on Zimbabwe in March 2002 stopped the supply of spares from the UK and the aircraft were grounded.***

by the conflict. Enslin eventually joined the besieged Zimbabweans and later escaped with them during their fighting withdrawal.

Subsequent investigations with the help of captured Rwandan troops revealed that the missile that hit Enslin's Hawk was "pedestal-mounted", suggesting it was probably an Anglo-French Matra/BAe Dynamics Mistral infra-red homing surface-to-air missile. The operator was a white mercenary; the Zimbabweans were aware that Israeli and South African mercenaries were operating in support of Rwandan troops in the area — two Zimbabweans were killed when their Toyota Land Cruiser hit a mine. Later, Rwandan prisoners-of-war indicated that a group of 18 white mercenaries were active in the battle of Kakuyu, operating MANPADS and mortars.

Contrary to reports otherwise, Enslin did not leave the AFZ after the conflict. He returned to service and in August 2000 won the "Jungle Dustbin Marksmanship Trophy" for air-to-ground gunnery, placing a record-setting 40 out of a possible 50 rounds on target during low-angle strafing runs. His colleague from the battle for Kinshasa, Flt Lt Ncube, was later promoted to CO of No 5 Sqn. With a satisfying symmetry it would be Maj Enslin who would subsequently take over the command of No 5 Sqn from Ncube.

KATSUHIKO TOKUNAGA / DACT VIA AUTHOR

North American B-25C serial number 41-12449, named **Fat Cat**, *has its engines run up at Dobodura, New Guinea, in October 1943, after its conversion from a strafer to a supply aircraft.*

CORPULENT KITTY

JUANITA FRANZI continues her regular series, in which she takes a detailed look at some lesser-known airframes and their markings, with a B-25C that used up all nine of its lives

NORTH AMERICAN B-25C serial number 41-12449, named *Fat Cat*, was one of the first examples to arrive in the wartime South-west Pacific Area (SWPA). During its long service it earned a special place in the history of the 90th Bomb Squadron (BS), and minted the generic term "Fat Cat mission".

This particular B-25's origins reflect the chaos of the early period of the Pacific War. Built to an American order, the first batch of B-25Cs, including '449, was allocated to the *Koninklijk Nederlands Indisch Leger* (Royal Netherlands East Indies Army — KNIL) in the Dutch East Indies (now part of Indonesia). However, soon after the first B-25C rolled off the production line, the Japanese bombed Pearl Harbor and, as the first KNIL B-25s were being ferried across the Pacific to Australia, Java in the Dutch East Indies fell.

Meanwhile, USAAF forces were arriving in Australia. Some were retreating from the Japanese advance while others, like the 3rd Bomb Group (BG), were arriving direct from the USA. The 3rd BG arrived in Brisbane with no aircraft and was deployed to the unfinished airfield at Charters Towers, inland from Townsville, Queensland. The airfield was completed in late March 1942 and 11 reallocated B-25s from the Dutch order arrived to equip the 90th BS, the inexperienced crew wrecking two on landing. More B-25s arrived in April and one of these, 41-12449, was allocated to 2nd Lt William "Red" Johnson and named *Fat Cat*.

The squadron's missions were rarely effective; medium- and high-level bombing techniques were insufficiently accurate to be used against shipping, airfields or other common targets in the SWPA. In late 1942 Paul "Pappy" Gunn and the 81st Repair Squadron at Townsville devised a modification to mount eight forward-firing 0·50in machine-guns on a B-25. Using these to suppress return fire, the aircraft could be used for low-altitude bombing and strafing missions.

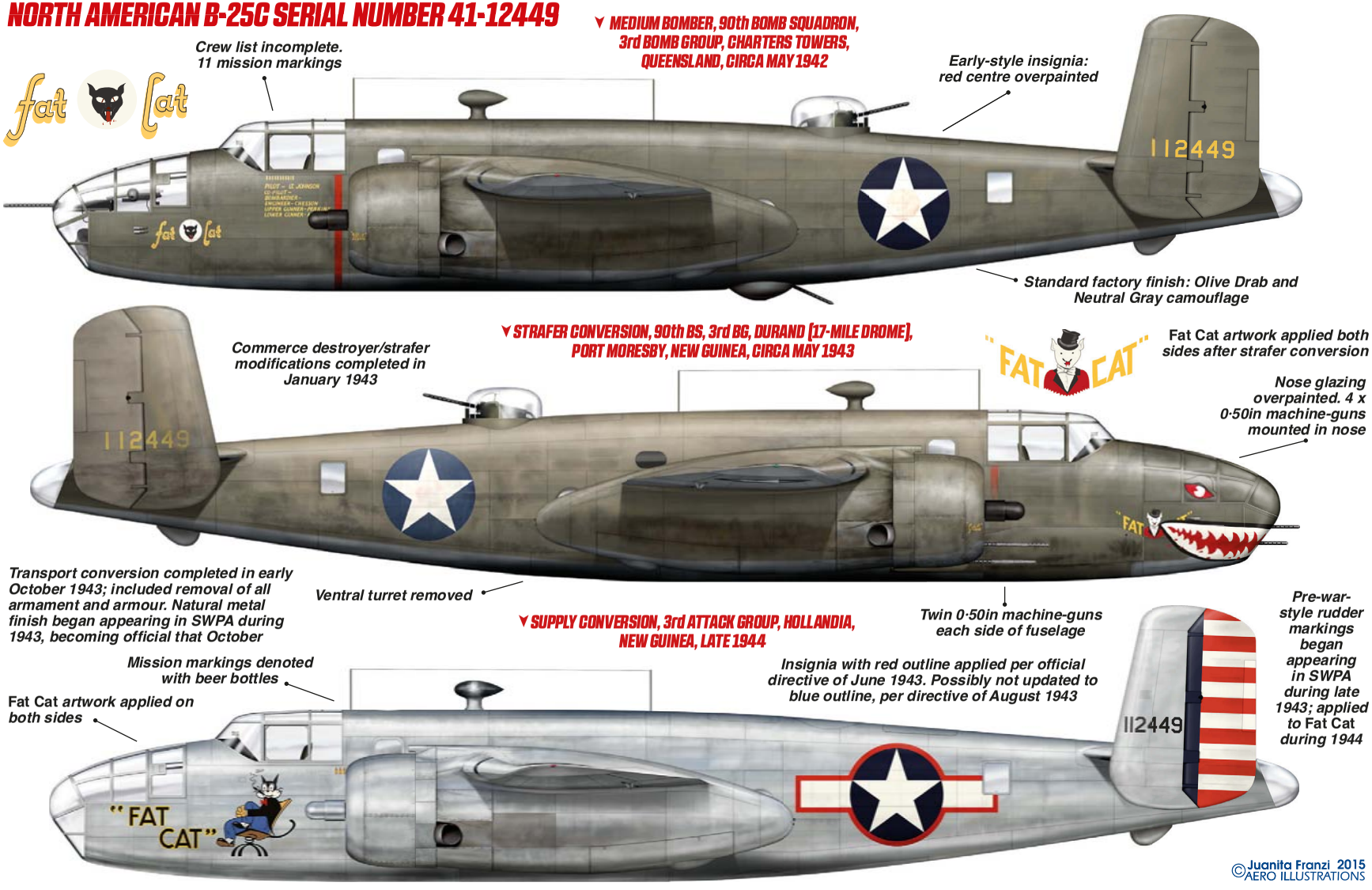
During December 1942 and January 1943 the B-25Cs of the 90th BS were modified into "commerce destroyers", or strafers as they came to be known. During February the unit practised "skip-bombing" techniques on a wreck off Port Moresby. A month later, during the Battle of the Bismarck Sea, the unit had the opportunity to use these new methods to sink several Japanese ships.

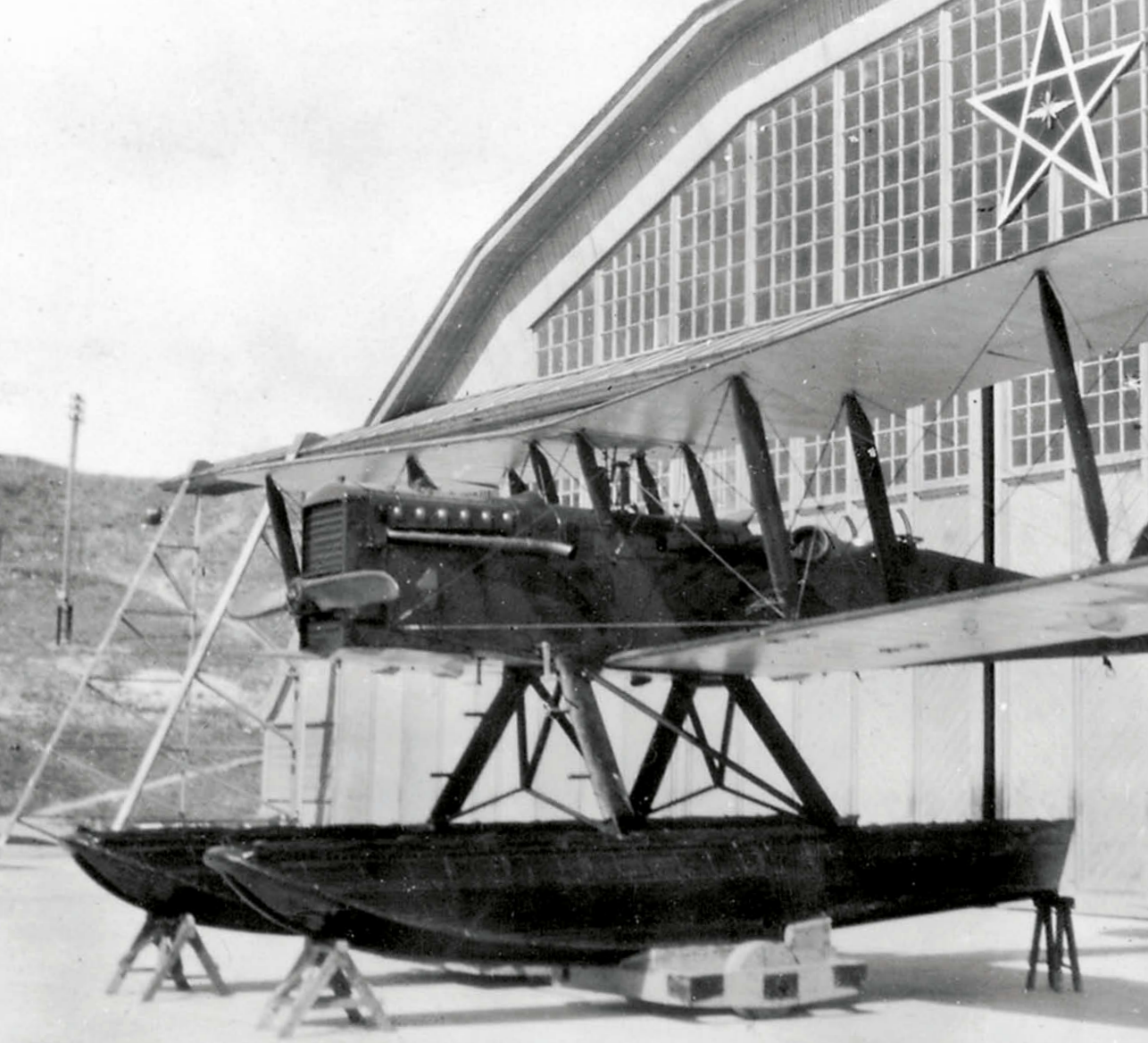
The squadron had found its niche and, with weakening Japanese aerial opposition, its losses reduced. *Fat Cat* continued flying missions until June 22, 1943, when the port mainwheel collapsed on return from a photo-recce mission. By that time the aircraft had logged 73 missions, flown 245 combat hours and had 380 repair patches.

It was decided to rebuild *Fat Cat* as a transport to bring food and urgent supplies from Australia, and in early October 1943 it was unveiled in its new guise. The luxuries of fresh milk, butter, vegetables and the occasional beer were greatly appreciated. Before long, all such unofficial supply flights were known as "Fat Cat missions".

Throughout 1944 *Fat Cat* served faithfully and in January 1945 assisted the 3rd BG's move to Mindoro in the Philippines. After three years of service, *Fat Cat* was finally retired in early 1945. The name was transferred to the unit's other converted B-25 supply aircraft, 41-30772, thus continuing the legacy of the original *Fat Cat*.

NORTH AMERICAN B-25C SERIAL NUMBER 41-12449





"WE HAVE OUR VERY OWN SOVIET ENGINE..."

In late 1917 two American automotive engineers created the outstanding Liberty aircraft engine, designed to be mass-produced on a huge scale. When a working example taken from a captured RAF Airco D.H.9A arrived in Moscow in 1921, Soviet engineers quickly set about reverse-engineering their own metric version, as **VLADIMIR KOTELNIKOV** relates

ALL IMAGES VIA AUTHOR

Soviet Russia's first mass-produced aircraft, the Polikarpov R-1 was essentially a reverse-engineered Airco D.H.9A powered by a similarly re-engineered copy of the type's Liberty L-12 engine. This example is a float-equipped MR-1, this variant seeing combat during operations over the Chinese Eastern Railway in 1929.

THE DEVELOPMENT OF America's highly successful Liberty aero-engine, which entered series production in 1918, had aroused interest in Russia even before the previous year's October Revolution. It was only during the ensuing Civil War between the Bolshevik Red Army and the anti-Communist White Army during 1917–23, however, that details of this innovative engine emerged.

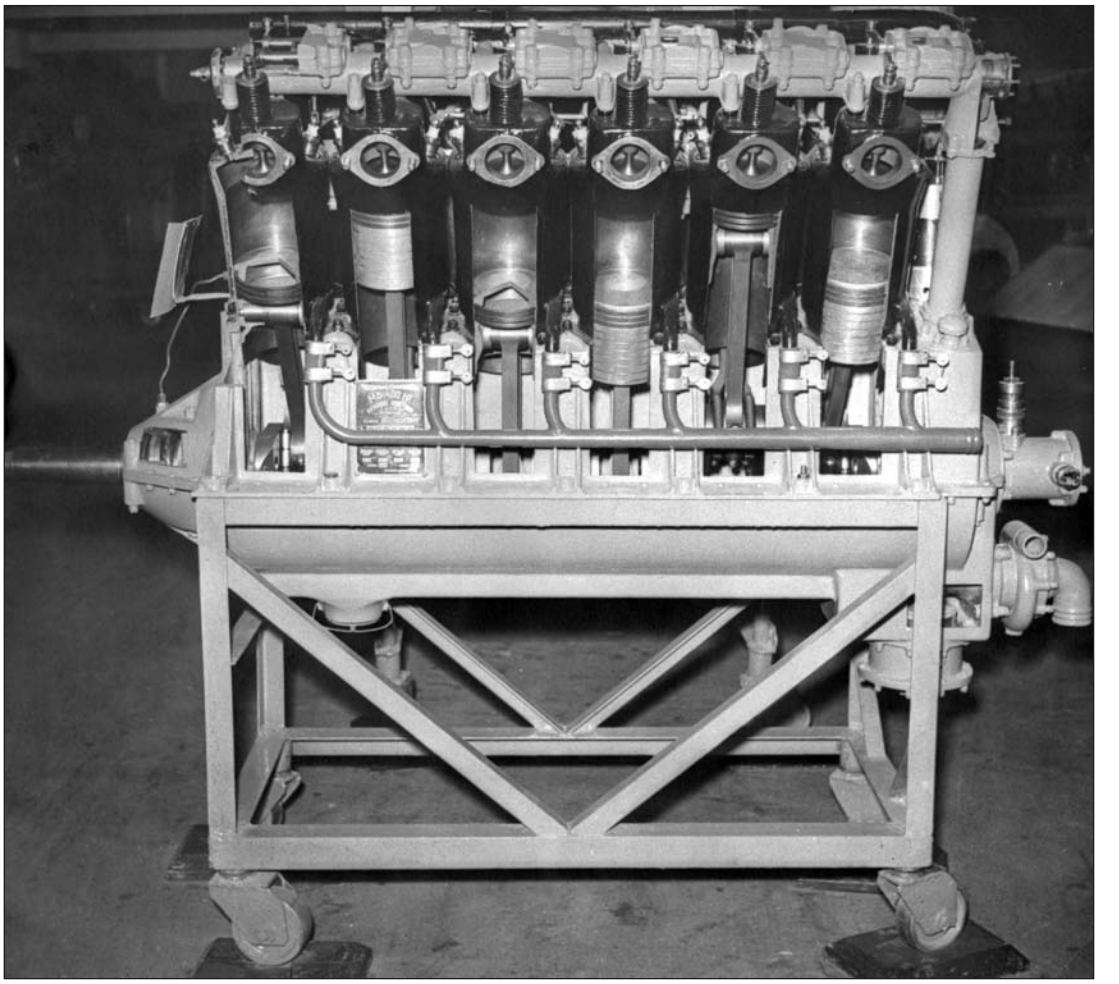
In December 1918 and April 1919 two RAF units, Nos 47 and 221 Sqns respectively, arrived in Russia in support of the Whites in their struggle against the Communists. Among the units' aircraft were Airco D.H.9A biplanes fitted with 400 h.p. Liberty L-12 engines, both units using the "Ninak" against Communist forces in the north and the south of the country. Many of the D.H.9As were subsequently handed over to the White Guards and several were captured by the Red Army.

One trophy D.H.9A, F1626, was brought to Moscow to be tested at the capital's scientific-testing airfield in 1920. Among the war prizes recovered by the Red Army from the Arkhangelsk region and brought to Moscow in April 1921 was a single Liberty in working order. It is likely that this was the "pattern" engine for the Russian-built examples that followed.

INTO PRODUCTION

Moscow State Aircraft Factory No 2 (GAZ 2), known as "Ikar" (formerly Gnome et le Rhône), soon received an order to copy the Liberty and set up series production. Drawings and other documentation began to be prepared from June 1922 by a team led by A.A. Bessonov and M.P. Makaruk. The original American Liberty was designed and constructed using imperial measurements, but the Soviets elected to use the metric system, resulting in the production of the M-5, which retained all the engine's original design aspects but used indigenous materials and was subject to its own system of fits and tolerances.

Several arrangements for series production of the Liberty in Russia were investigated. Although many manufacturers were willing and able to produce the engine and its components, it was intended initially to task the GAZ 2 and GAZ 4 ("Motor") factories in Moscow, the GAZ 9 plant in Zaporozhye on the banks of the Dnieper in south-eastern Ukraine, and the "Bolshevik" factory in Petrograd (later renamed Leningrad, now St Petersburg) with production. The last-named had never been an aviation factory, and was subordinate to the Directorate of Military and Naval Industry of the North-



ABOVE ***An M-5 engine on a cradle at the Salyut engine factory museum in Moscow, which traces its heritage back to the GAZ 4 "Motor" manufacturing plant. This particular M-5 was not built at the Ikar factory in Moscow or at the Bolshevik plant in Leningrad, so it is likely that it was built at GAZ 4, sectioned and used as an educational aid.***

western Region (*Sevzapvoenprom*) and later to the military-industrial complex. Production was to be based on co-operation, with each factory producing its share of components and sending them to Moscow for final assembly. Talks were held with German aircraft manufacturer Junkers about the possibility of producing the Liberty at the company's joint-venture factory (with the Soviet GAZ 7) in Fili, a suburb of Moscow. This plan was later rejected and replaced by a proposal to divide production into three parts, with the Liberty to be produced independently at three factories — GAZ 2, GAZ 4 and Bolshevik. In the event the decision was taken to produce the M-5 Liberty only at the GAZ 2 and Bolshevik factories. The latter option required new equipment to be purchased from overseas, while some was brought in from other factories.

The first order, for a prototype example, was placed with the Ikar factory on July 11, 1922, followed by an order for a series of 25 engines, later increased to 40, that September. The Ikar factory immediately set about producing a series of five prototype engines, the first of which was successfully bench-tested and passed on November 27, 1924. By this time factory inspectors had received four engines, but only three of these had completed the full programme of factory testing by June 1 the following year.

The maximum output obtained from the homegrown prototypes was 410–440 h.p. The military acceptance committee, however, rejected the entire "A Series" of five engines, which were found to be non-interchangeable. The untested technology had led to the use of manually fitted parts to ensure serviceability. Moreover, it was established that the output was achieved by increasing the compression ratio, which had a deleterious effect on the powerplant's service life. The reason was traced to incorrectly manufactured castings for the pistons.

On the next batch of 15 "B Series" engines, the

THE LIBERTY: AN AMERICAN CLASSIC by Graham White

WHEN THE USA entered the war in 1917, its aviation industry was fast approaching obsolescence in comparison to developments in Europe. This revelation is perhaps somewhat surprising considering that the Wright brothers had made the first controlled, powered heavier-than-air manned flight in America in 1903 and luminaries such as Glenn Curtiss had made significant advances in aviation before the First World War.

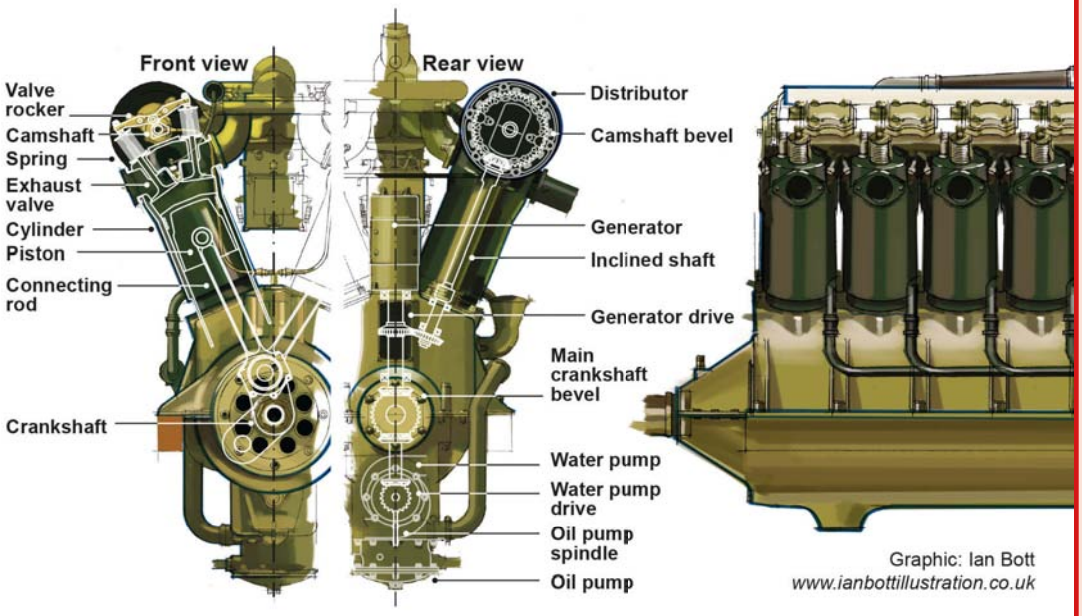
One of the first issues that faced the US Department of War after hostilities had erupted in Europe was to develop a competitive aircraft engine. This offered two alternatives; the first was to develop an engine from scratch and the second was to build a foreign engine under license. The choice taken was to adopt the former course — but time was short.

The Department of War brought together two of the most highly respected engine designers of the time and sequestered them in a suite of rooms at the Willard Hotel in Washington DC in early June, 1917. These two individuals, who'd never met despite being aware of each other's reputations, were Jesse Vincent of the Detroit-based Packard Motor Car Co and Elbert John Hall of the Hall-Scott Motor Car Co, based in Berkeley, California. For five days the two stalwart engine designers laboured over their drawing boards assisted by a team of designers and draughtsmen. Reportedly, neither of them left the suite of rooms assigned to them during the five-day thrash. All detail drafting was complete by June 17, 1917, by which time prototype parts were already being made.

The outcome of all this activity was a water-cooled V12 aero-engine. Before the First World War German company Mercedes had developed an engine for motor-racing that established water-cooled design philosophy for aircraft engines. Separate cylinders, fabricated from sheet metal and attached to an aluminium crankcase, paved the way for the new aero-engine's basic design, in which the cylinders were manufactured from a steel forging and the combustion chamber, intake and exhaust ports were welded to the cylinder barrel. A thin sheet-metal cooling jacket was brazed on to the cylinder barrel. The crankshaft was a standard 120° item with no counterweights, supported by seven bearings in an aluminium crankcase.

Interestingly, the vee-angle was a non-standard 45°. For an even firing sequence a vee-angle of 60°, in conjunction with a 120° crankshaft, is standard design practice for a V12. Contemporary reports indicate that the new engine's 45° angle was chosen in order to reduce the frontal area of the engine and thus reduce drag. Each bank of cylinders used a single overhead camshaft driven by a tower shaft and bevel gears. The two valves per cylinder were set at a relatively small included angle producing a quasi-hemispherical combustion chamber. Reflecting the automotive background of Hall and Vincent, a battery-coil ignition system was used to fire the two spark plugs per cylinder. Standard aircraft practice was to use a magneto which requires no external source of electrical power. Few World War One aircraft engines had provision to drive a generator, but with a battery-coil ignition system this was essential. Forced-feed dry-sump lubrication was employed.

By December 1917 production tooling was in place and examples of the new engine, initially known as the US Standardised Aircraft Engine but quickly given the appropriate and rather less bureaucratic name Liberty, were being produced in very high numbers. By December 1918 an astounding 20,478 Liberty L-12s had been produced by five automotive companies, all but one based in Detroit: the Lincoln Motor Co (6,500); Ford (3,950), Packard (6,500), General Motors (Cadillac and Buick divisions, 2,528) and Indianapolis-based Nordyke & Marmon (1,000). Stemming from the basic V12 design, the intent was to develop a family of engines using as many standard parts as possible. Thus a 45° V8 and in-line V6 and V4 variants were developed, but very few of these were ultimately manufactured.



Graphic: Ian Bott
www.ianbottillustration.co.uk

ABOVE ***A factory-fresh Polikarpov R-1 awaits delivery in 1930 at Factory No 31 at Taganrog on Russia's south-western border with Ukraine. The type entered service with the*** **Voyenno-Vozdushnye Sily** ***(V-VS — Soviet Air Force) in the summer of 1924. By the end of production some 2,500 examples of the R-1/MR-1 had been built.***

bases of the pistons were simply milled, reducing their height. This also reduced their thickness, however, and the pistons began to burn through. The castings had to be remade. Slowly and gradually, the M-5 was brought up to the required standard of quality.

Liberty production was also started concurrently in Leningrad (as Petrograd was renamed in 1924), where 30 engines had been manufactured by mid-1925. Significantly, the Moscow and Leningrad engines differed from one another. Production was adjusted to the equipment and tools available, and to tested production methods. At the Ikar plant changes were continually being introduced, taking into account the results of testing. In this respect the Bolshevik factory lagged behind. As a result, engines from Moscow and Leningrad were only partly interchangeable and were usually designated M-5I and M-5B respectively.

Even the price was different. The first series of the M-5I cost 22,600 roubles, but the M-5B was more expensive at 25,000 roubles. However, the quality of the Leningrad-built engines was initially regarded as higher. Even here, significant variations were noted in the compression ratios of different cylinders, together with high tolerances in the weight of the components, which affected the engine's balance. The variation in the dry weight of an engine could be up to 10kg (22lb).

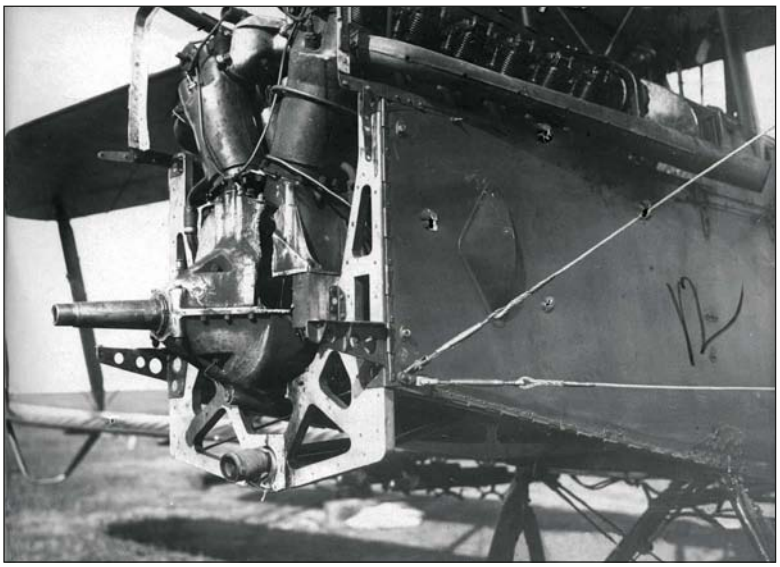
The M-5 was the first aero-engine under the Soviet regime to be introduced into production independently from beginning to end. It was significantly superior to the M-2 (le Rhône Jb) and the M-4 (Hispano-Suiza 8Ab), according to the licence documentation purchased by the then-Tsarist Government. A decree from the *Revvoyensovet* (Revolutionary Military Council) of the USSR, dated April 5, 1925, stated proudly: "We have our very own Soviet engine".

It was, of course, not entirely a "Soviet engine", not even in terms of production, let alone design. The ignition system, fuel pumps and fuel-line equipment had been bought in from abroad, namely Germany, France and the USA. Some engines were fitted with American crankshafts purchased through the Packard and Atlas companies. Indeed, the entire "Zh Series", manufactured at the Moscow factory, was fitted with these crankshafts. These engines were known as "semi-metric", as the matching components for the crankshafts also had to be manufactured using the imperial system.

FLIGHT TESTING

Having completed its acceptance trials, the M-5 began to be sent to aircraft-manufacturing plants. By March 1, 1925, the GAZ 1 factory in Moscow had received four M-5I engines and one M-5B. These first Soviet-built Liberty engines were fitted to examples of the Polikarpov I-1 monoplane and Grigorovich I-2 and I-2bis biplane fighters, as well as the first-series of the all-metal Tupolev R-3 biplane reconnaissance aircraft. Several other prototype aircraft were also fitted with early production M-5s.

The principal aircraft type to be fitted with the M-5 engine, however, would be the wooden Polikarpov R-1 biplane light bomber/reconnaissance aircraft, the most widely produced aircraft in the Workers' and Peasants' Red Army Air Force during the 1920s. Externally indistinguishable from the D.H.9A, this was indeed a straight copy of de Havilland's creation, although Soviet designers altered the fuselage framework, incorporated a different wing profile, increased the aircraft's fuel capacity and changed the type's standard armament. Alongside the R-1 landplane (the mainwheels replaced by skis in wintertime), a float-equipped MR-1 variant was also manufactured.



LEFT ***With the radiator removed, the front section of the M-5 on this R-1 is clearly visible. This aircraft was one of many R-1s used for training duties, this example serving with the Borisoglebsk Flying School in the Voronezh region in the summer of 1930.***

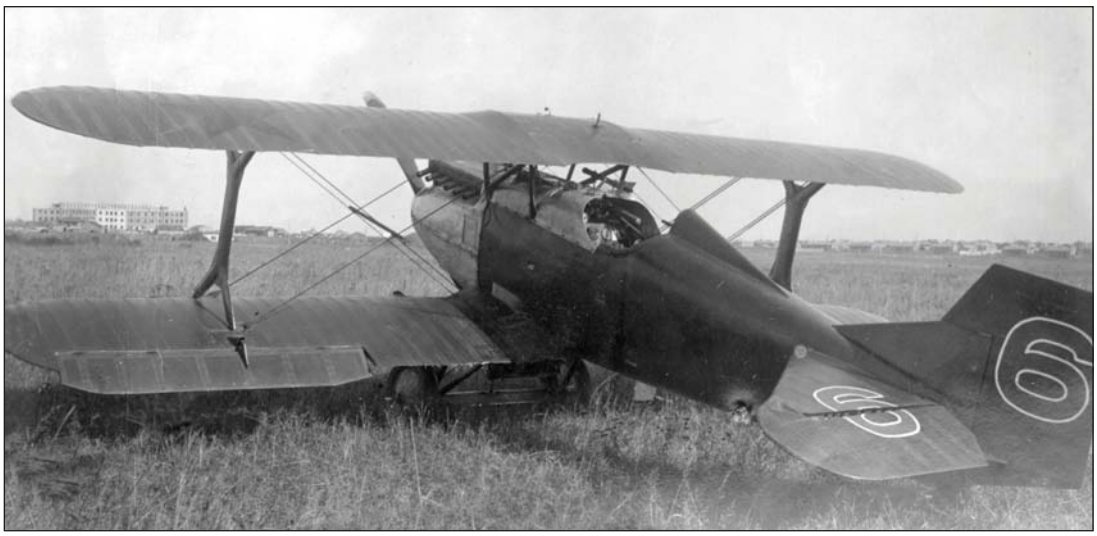
BELOW ***The Grigorovich I-2bis fighter was also powered by the M-5 engine, the type making its first flight in 1925 in the hands of test pilot A.I. Zhukov. The I-2bis was the first Soviet-designed fighter to be put into large-scale production, approximately 210 examples being built during 1925–29.***

It was on the R-1 that the Soviet Liberty was first tested in flight. An example was fitted with an M-5I engine and flown by pilot Inshakov along a route that ran Moscow—Kharkov—Kiev—Smolensk—Moscow. Another R-1, fitted with an M-5B and crewed by Rasstegayev and Kurbatov, completed a long-range Moscow—Smolensk—Leningrad—Moscow flight.

Between June and August 1925 two R-1s fitted with M-5B engines flew, along with other types, on the Great Eastern Long-Range Flight from Moscow to Peking in China. The two R-1s then continued the journey to Japan, and on September 2, 1925, the famous pilot Mikhail Gromov landed in Tokyo. The second crew, led by M. Volkovoynov, landed in Shimonoseki in southern Honshu, owing to worsening weather. In 1926 Soviet pilots completed long-range flights to Tehran in Iran and Ankara in Turkey, the engines in these aircraft being Soviet-built.

The R-1 was manufactured in great numbers, which ultimately led to a shortage of indigenous M-5s. As a result, the Soviet Union completed the purchase of original Liberty engines from Britain and the USA, mostly used examples which had been put into storage. The engines from the UK were overhauled and adjusted and fitted more or less immediately. Those sent by the Americans, however, were sent direct from the stores and were dirty and rusty. In mitigation, they had been purchased at almost scrap prices.

Significantly, later production variants of the Liberty began to arrive in consignments from the USA; some of the components had been improved and some of these improvements were incorporated into Soviet-built M-5s. These later engines incorporated tulip-valves, the design of the synchroniser was changed, the mixture-



distribution mechanism was strengthened, the bottoms of the pistons were made thinner and the number of components made from light alloys was increased. The Soviet purchase of Liberty engines from abroad continued until 1930.

THE M-5 IN COMBAT

The R-1 saw active service with the V-VS (Soviet Air Force) as a reconnaissance aircraft and light bomber during the late 1920s and early 1930s. The type was used in combat against the Chinese over the Chinese Eastern Railway during the Sino-Soviet War of 1929 and in the struggle against the Basmachi Muslim uprising in central Asia during the 1920s and 1930s. Following the introduction into service of the Polikarpov R-5, a new reconnaissance aircraft, the old biplanes were transferred to flying schools and auxiliary units, with which they operated until 1936.

The M-5-powered R-1s were also used for operations in Afghanistan, China, against rebel forces in Luristan (now Lorestan Province in Iran), as well as during conflicts with tribes in outlying regions of Mongolia and during fighting with the Japanese on the border with Manchukuo in 1936.

Production of the M-5 increased, and it was Soviet Russia's most widely produced aircraft engine of the 1920s. Designed quickly back in the First World War, the Liberty engine soon became obsolete. In 1923 work began on modifications for the powerplant and others based upon it. Soviet designers used two approaches; adapting the design to the requirements of indigenous industry while aiming to increase output. Not everyone supported the idea of continuing to develop the Liberty, however. A counter-proposal was made that production of other foreign engines — Britain's Napier Lion and the American Wright T-3 (V-1950) Tornado, for instance — should begin, or that the emphasis should be on designing original indigenous engines. By 1925 however, production of the M-5 had been so well assimilated it was decided that a route leading to the production of a family of engines based on the M-5 would be fundamental. Both the State Aviation Industry Trust of the Chief Administration of the Metal Industry (Aviatrest) and the V-VS Directorate agreed on this point.

The 440 h.p. M-10 development of the M-5 was designed at the Ikar factory in 1924. Still essentially

POLIKARPOV R-1 DATA

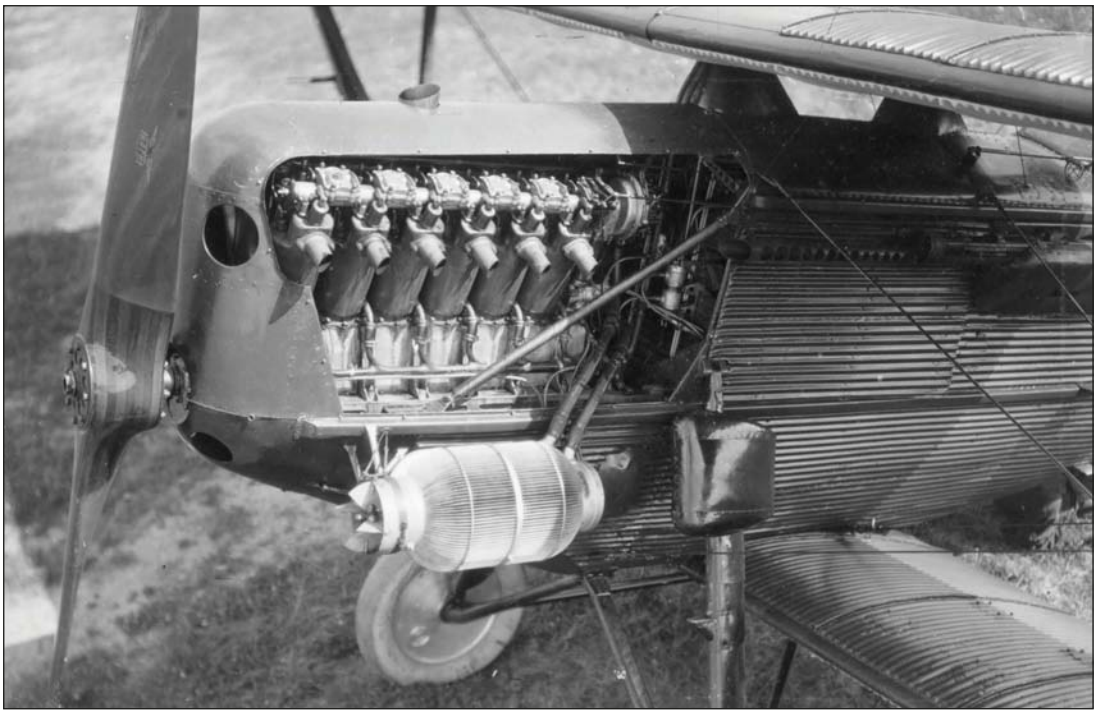
Powerplant 1 x 400 h.p. M-5 liquid-cooled 45° V12 piston engine

Dimensions		
Span	14·02m	(46ft 0in)
Length	9·23m	(30ft 3½in)
Height	3·46m	(11ft 4in)
Wing area	44·5m²	(479ft²)
Weights		
Empty	1,450kg	(3,197lb)
Loaded	2,217kg	(4,888lb)
Performance		
Maximum speed	185km/h	(115 m.p.h.)
Normal take-off distance	250m	820ft
Landing distance at 90km/h (55 m.p.h.)	200m	655ft
Climb to 1,000m	4½min	
Service ceiling	5,790m	(19,000ft)
Normal range	700km	(435 miles)

Armament
1 x fixed forward-firing machine-gun; 1 x single or double machine-gun on flexible mount in observer's position.

Bombload	480kg	(1,060lb)

Changing the M-5 engine on an R-1 of the 19th Aviation Detachment in Khabarovsk in December 1928. The R-1 began to be replaced in service by the BMW-powered (or Soviet version thereof) Polikarpov R-5 from 1931, after which the R-1 was relegated to purely training duties.



ABOVE ***The M-5 engine was also fitted to the Tupolev R-3 reconnaissance biplane, built using the new Kolchug construction technique, similar to the corrugated structures used by Junkers. The R-1's large drag-inducing radiator was replaced on the R-3 with a pair of Lamblin "lobster pot" radiators, one of which is clearly visible here.***

a Liberty, the new engine included a 60° angle in the cylinder banks and a conventional aviation-industry magneto ignition system, as opposed to the M-5's automobile-based system. Testing of a prototype took place between September and December 1926. A simplified, re-worked example appeared during November—December 1928 with the same cylinder-bank angle as the Liberty (45°), but fitted with a more complex magneto system, with irregular intervals between firings. In the event this new system was rejected.

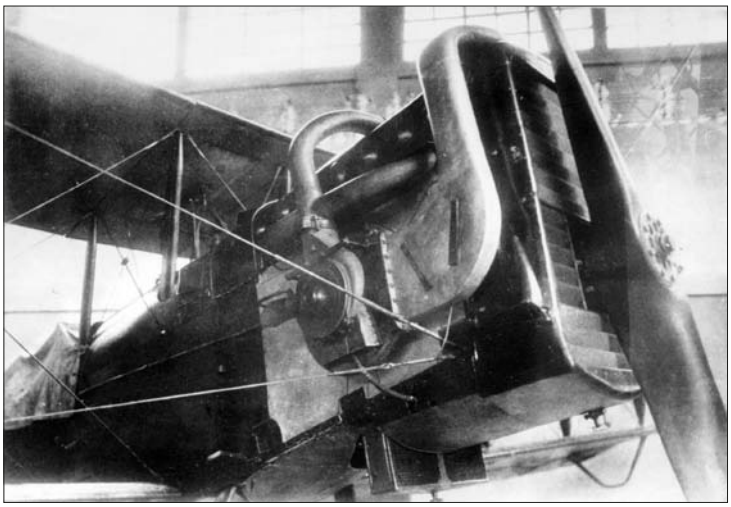
SUPERSIZING THE LIBERTY

The search for increased output continued at the same time, the priority being to increase the number of cylinders. In 1923 G.M. Gorokhov worked on a 16-cylinder X-type "Liberty X" engine, later designated M-9 by the Central Automobile & Automotive Scientific Research Institute. The desired output was 530 h.p., but a prototype example was never manufactured as the design was considered prohibitively complex.

The designers at GAZ 24 — an amalgamation of the Ikar, Motor and what was left of the Amstro factories following a fire — chose a qualitative modification. The team, including Arkadiy Shvetsov and Vladimir Dobrynin, worked on the M-14, which differed from the M-5 in having bored-out and shortened cylinders, a cylinder-bank angle of 60°, a new crankshaft and a magneto ignition system. The r.p.m. and the compression ratio were increased in comparison with the original Liberty. Two examples were manufactured (the second with an even higher compression ratio) and were tested from March 1928. Output reached 480 h.p., although the engine was designed for 500 h.p. It was proposed that an inverted M-14P and a six-cylinder in-line M-16 be manufactured, but all work on the M-14 and its derivatives was stopped in December 1928.

Another attempt to modernise the M-5 was produced by engineers Brilling and Aleksandrov at the Central Automobile & Automotive Scientific Research Institute during 1924–25, with the introduction of roller crankshaft bearings and strengthened components. The increase in output was around the same figure — up to 450 h.p. Some of the components from this design were used later in the 18-cylinder V18-1 engine which, in engineering terms, retained almost nothing from the Liberty. By the end of the 1920s, all work on modernising the M-5 had been stopped.

None of this development work had any significant effect on series production of the M-5. No cardinal changes were introduced into the design, and the maximum output remained



RIGHT *In 1935 a single M-5-powered R-1 was fitted with a General Electric turbocharger for tests at the V-VS Scientific Research Institute. Although the M-5 was completely obsolete by this time, useful technical and operational information about turbocharging was accrued and the results incorporated into newer aircraft and engines.*

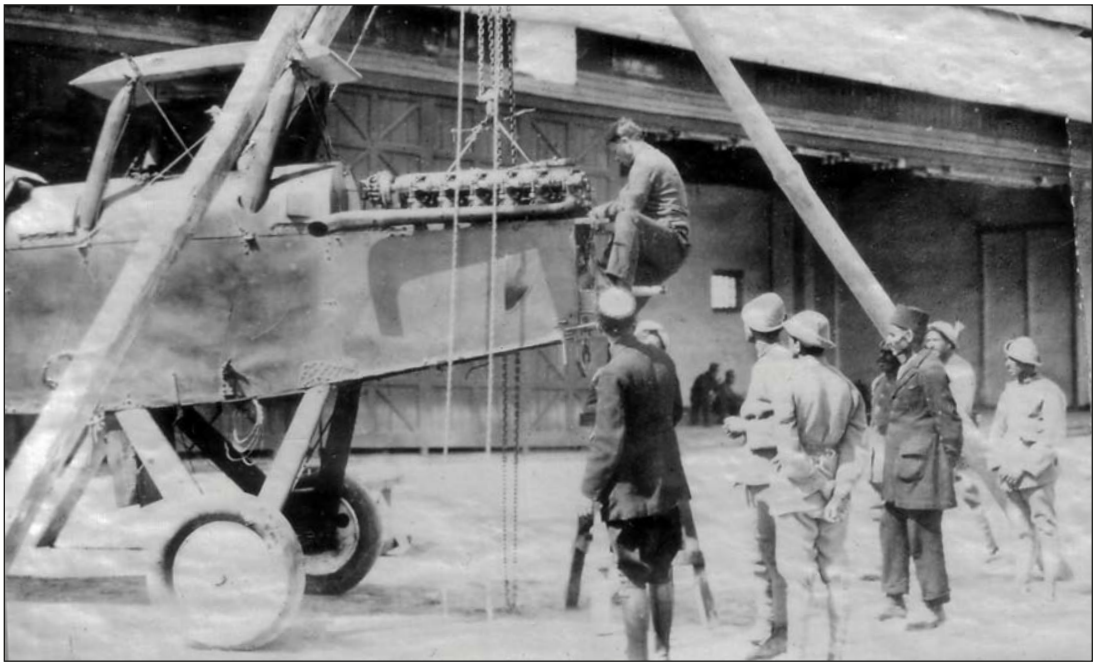
BELOW *Changing the M-5 on an R-1 in Kabul, Afghanistan, in 1925. The original American Liberty also proved its inbuilt ruggedness, the engine still powering US Army Air Corps types into the mid-1930s.The Liberty's combination of power and lightness was a quantum leap from the heavy but durable engines that preceded it.*

unchanged. Efforts largely focused on improving reliability and fine-tuning the basic technology. As a result, the M-5's service life increased and principal defects in the early-series engines were corrected. By the end of 1926 the price per unit had been reduced to 15,886 roubles.

INBUILT UBIQUITY

Production of Soviet-built Liberty engines increased until 1929, when some 997 examples were manufactured. The following year production of aero-engines at the Bolshevik factory was stopped, and production also slowed at GAZ 24 in Moscow. At the end of 1930 the M-5 was withdrawn from series production, although the V-VS Directorate thought this premature considering the large number of R-1 aircraft still operating at flying schools. This led to a short revival of M-5 production in 1932, when the final 80 were handed over. In total, some 2,829 M-5 engines were manufactured and the R-1 was used at flying schools until the late 1930s.

A single M-5 was fitted with an American-supplied General Electric turbocharger in early summer 1935 and underwent flight-testing in an R-1 at the V-VS Scientific Research Institute, a total of 17 flights with the modified engine being made. The trials focused on the turbocharger, however, and an M-5 was used simply because of its compatibility with the American equipment. The engineers were interested exclusively in the turbo compressor and its potential.



LEFT ***Another application for the M-5 engine was its installation in the Soviet Union's BT series of high-speed tanks, affectionately known as Betka or Betushka from the acronym for*** **Bystrokhodny Tank** ***— high-speed tank. Again, the concept came from an American, J. Walter Christie, who designed the BT convertible tank — the tracks could be removed — during 1930–31.***

BELOW ***Students at the snappily-named Workers' & Peasants' Red Army Academy of Mechanisation & Motorisation study the M-5 powerplant in a BT-5 tank. The BT series of tanks saw action in the Sino-Japanese War, the Spanish Civil War, the Winter War in Finland and throughout World War Two.***

Another application for the M-5 was found at the beginning of the 1930s — tanks. A design was developed to convert used aero-engines into tank engines (the engines sometimes being designated M-5T). The maximum r.p.m. was limited, the tailshaft was reworked and forced-air cooling fans were installed. The Leningrad Bolshevik factory undertook the modifications on M-5 engines transferred from V-VS stores.

The former aero-engines were installed in Christie-style *Bystrokhodny tank* (high-speed tank) vehicles, including later-series BT-2s, BT-5s and BT-5As. Owing to a shortage of Soviet-built M-5s, used Liberty engines were purchased from the USA, overhauled, repaired and modified as per the M-5T at the Bolshevik plant.

Examples of the M-5 which had used up their service life for aviation purposes were also installed on type A-2, A-11, A-12, A-13, A-14 and A-16 propeller-driven boats. The Marti shipbuilding yard in Leningrad worked on a variant of this engine for patrol boats with a reverse clutch based on an example obtained in America. It is not certain, however, whether a prototype example was manufactured.

The Soviet M-5 Liberty engine played a major part in the establishment of Soviet aviation during the 1920s. Today, a few examples which were used as educational aids have been preserved in various museums in Russia, as a reminder of Russia's first foray into the development and construction of a homegrown aero-engine.

Folland's Forgotten Monoplanes

Part 3: Henry's last stand at Gloster Aircraft

In the final article in his three-part series on the little-known 1930s monoplane designs of Henry Folland, **RALPH PEGRAM** explains how the merger of Gloster and Hawker left the designer feeling vulnerable and despondent, leading to his final project for the company; a monoplane bomber designed with Major Robert Mayo's "piggyback" concept in mind

BY 1935 HENRY P. Folland was not at all a happy man. Following the acquisition of Gloster by Hawker Aircraft Ltd (HAL) the previous year, he was deeply concerned that he may be viewed as subordinate to HAL's chief designer, Sydney Camm. Folland was also frustrated by his struggles to obtain contracts for modern all-metal monoplane designs *[as covered in the first two parts of this series in* TAH9 *and* TAH10 *— Ed]*.

Despite having just won a contract for two prototypes of a monoplane fighter to Specification F.5/34 (the first of which, K5604, is seen at **TOP**), he was well aware that this Specification was of lesser interest to the RAF than either the Hawker Hurricane or Supermarine Spitfire, and was unlikely to result in a production contract. His team was working on other fighter designs to meet Air Ministry specifications, but what turned out to be Folland's last design for Gloster was a collaborative private-venture bomber that had its origins in a failed disarmament conference and an innovative idea to carry transatlantic airmail.

INTER-WAR BOMBER CHALLENGE

The covenant of The League of Nations obligated member states to work to achieve a reduction in national armaments, but its delegates made little progress. In January 1931 it was agreed to convene a full conference. The Conference for the Reduction & Limitation of Armaments opened in Geneva in February 1932 with 60 nation states participating and with no formal agenda.

PHILIP JARRETT COLLECTION

ABOVE ***Henry Folland (furthest right) at a gathering in the mid-1930s. Fellow aircraft designer R.J. Mitchell, creator of the Sptifire, is seated at far left. Folland had joined the Gloucestershire Aircraft Company as Chief Engineer and Designer in 1921. The acquisition of the renamed Gloster by Hawker in 1934 left Folland feeling decidedly uneasy.***

The scope of the Conference was extremely broad and its task daunting, yet it was launched with considerable vigour and a tangible degree of optimism. On the question of air forces, a range of possible formulæ had been suggested by the League's Commissions; in essence these would place restrictions on the total number of the various categories of aircraft and the horsepower of their engines, and several state delegations tabled proposals in their opening addresses.

The boldest of these suggestions, put forward by the USA and others, was a ban on all aerial bombing and bomber aircraft. This was indeed a radical departure, as the credo of a strong bomber force to form the backbone of a nation's deterrent against attack was widely supported in Europe. However, the spectre of unconstrained bombing of civilian targets haunted the world's governments and there was an appetite, at the very least, to rein in the excesses. But by mid-1932 little material progress had been made, other than a general agreement to a resolution that air attack against the civilian population should be absolutely prohibited.

In March 1933 the British delegation submitted a draft convention to the Conference which comprised the following:

- adopting the proposal to ban aerial bombing (with a few exceptions);
- setting an upper limit on the total number of military aircraft available for each nation state;
- fixing a maximum limit of 3 tons (3,050kg) on the unladen weight of military aircraft.

It was this last proposal that was to shape the Air Ministry's contemporary specifications for British bomber aircraft.

In mid-1933 the RAF's force of heavy bombers comprised a motley collection of ageing Vickers and Handley Page biplanes, all in dire need of replacement. The latter's Heyford, another biplane, was due to enter service at the end of the year and the Fairey Hendon monoplane was on the verge of gaining a production contract. At 4 and 5½ tons unladen weight respectively, both would be banned should the British Convention be adopted. The Boulton & Paul Sidestrand, classed as a medium bomber and weighing a little under 3 tons, just made the cut, while its upgraded successor, the Overstrand, exceeded the limit by half a ton.

The standard bombload for these medium bombers was 1,000lb (455kg), which could be pushed to 1,500lb (680kg) at a stretch, with a trade-off against range. So, although it ran counter to the spirit of the proposed weight limitation, the task for the Air Ministry and the British aircraft industry was to find a means by which a meaningful bombload could be carried by a relatively light aircraft. The most direct method was to minimise the weight of the airframe,

an objective central to aircraft design anyway, and this acted as a spur to the development of innovative structures, such as Barnes Wallis's geodetic framework.

In-flight refuelling was also a possibility but the development of a viable method was still very much in its infancy. Sir Alan Cobham had undertaken some preliminary trials in 1932 in support of his long-distance flights, but it would be two more years before he was sufficiently confident in the concept to establish a company to refine the system.

A third method, which had been under assessment by the Royal Aircraft Establishment (RAE) at Farnborough since 1922, was the use of a catapult. By the early 1930s the mechanism had been modified so that the aircraft was no longer required to sit on a catapult cradle but instead ran along the runway on its own wheels and was accelerated by the catapult via a cable and fixed pulley. This had the advantage of being able to handle far heavier aircraft than was possible with a conventional catapult. This became the favoured method of the Air Ministry for several years, and was written into various specifications throughout the mid-1930s. But there was a fourth possibility; to carry the heavily-laden bomber aloft on the back of a second aircraft.

MAYO & THE PIGGYBACK CONCEPT

Small aircraft had been carried and launched in flight by larger host aircraft or airships on several occasions in the 1920s, primarily as a possible means to provide fighter defence for the carrier while in flight. The idea had proven to be workable but of limited interest. Then, in 1932, Major R.H. Mayo obtained a patent for a system in which the host aircraft was to serve solely to air-launch a heavily-laden prime aircraft.

Robert Hobart Mayo was born on September 25, 1890, and held a degree in mathematics from Magdalene College, Cambridge. He specialised in mechanics and was employed by the Royal Aircraft Factory at Farnborough (as Folland had been), where he was promoted head of the experimental department shortly before the First World War. On the outbreak of war he resigned and joined the Royal Flying Corps, obtaining Royal Aero Club Aviator's Certificate No 1023 on Christmas Eve 1914.

After serving on the Western Front and rising up the ranks, he was recalled to the UK, first to work with the Aeroplane Experimental Station at Martlesham Heath in Suffolk, where he was promoted Major; and during 1917–19 was Head of Design (Aeroplane) Section, Technical Dept

ABOVE ***Major Robert H. Mayo (right) alongside Short Bros test pilot John Lankester Parker, who, along with fellow test pilot Harold Piper, made the first successful in-flight separation of the sole Short Mayo Composite (the bottom half of which, G-ADHK,*** **Maia,** ***may be seen in the background) on February 6, 1938.***

The Boulton & Paul Sidestrand was the first RAF aircraft to be designated as a medium bomber, entering service with No 101 Sqn (the only unit to operate the type) in March 1929 and remaining on strength until 1936. Folland and Mayo's bomber design was intended as a replacement for the ageing, but surprisingly agile, biplane bomber.

TAH ARCHIVE

PHILIP JARRETT COLLECTION

ABOVE ***The Short Mayo Composite comprised the S.20 floatplane, registered G-ADHJ and named*** **Mercury**, ***and the lower S.21, G-ADHK, named*** **Maia**. ***The Composite proved itself over several long-distance flights during 1938, including a transatlantic crossing to Montreal and flights by the air-launched*** **Mercury** ***to South Africa and Egypt.***

of the Air Ministry, for which he was awarded an OBE. In 1919 he resigned from the Ministry and joined Alec Ogilvie, Col W. Bristow and others in Ogilvie & Partners, a team of aviation consultants. *[See Alec Ogilvie's memoir of his early flying days,* Echoes From Dawn Skies: Early Days at Eastchurch, *in* TAH6 *— Ed.]*

In 1924 Mayo was engaged as a Consulting Engineer to the newly-formed Imperial Airways, which post he fulfilled through to the early 1930s when the role was formalised and he was appointed Director (Technical). His work with the airline included drawing up the specifications for new aircraft and working closely with aircraft manufacturers. One of the tasks allocated to Imperial Airways by the Government was to carry mail throughout the Empire, for which the need for specialised high-speed long-distance mail-carriers seemed clear. Mayo was responsible for drawing up appropriate specifications for this class of aircraft.

While considering ways in which extensive range could be achieved, with transatlantic and transafrican flights the goal, he came up with the idea of a composite aircraft, the lower component serving simply to get the heavily loaded mail carrier into the air. He submitted a patent application for this concept in April 1933. In 1935 he established the Mayo Composite Aircraft Company Ltd to market and exploit the patents.

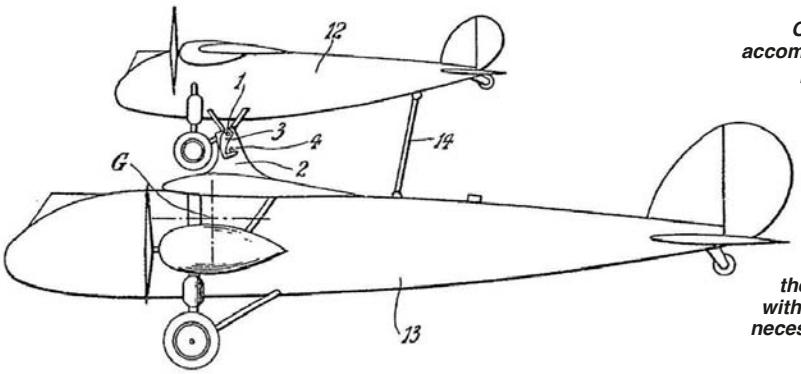
Mayo presented the composite aircraft idea to Imperial Airways and the Air Ministry, which agreed to fund the construction of prototypes to evaluate the merits of the concept. In line with contemporary Imperial Airways policy for long-range aircraft, the mail carrier had to be able to alight on water, and it was logical that it should also be a marine aircraft, as this allowed for an unrestricted take-off run.

The contract for both aircraft was awarded to Short Brothers, probably without competitive tender as no designs are known from other aircraft companies. The lower component was a flying-boat related closely to the company's passenger-carrying "C-Class" Empire flying-boats also ordered by Imperial Airways, and the upper component was a twin-engined floatplane. Encouraged by this success, Mayo sought other opportunities for the composite concept, particularly for military application. *[For more on the Mayo Composite see John Lankester Parker's memoir,* Echoes From Dawn Skies: Better To Be Born Lucky Than Rich *in* TAH8 *— Ed.]*

MAYO'S MILITARY PROJECTS

Although the collapse of the Geneva disarmament conference, prompted by the withdrawal of Germany and a general lack of agreement among the other parties, meant that the weight limit on bombers was abandoned, there was still merit in pursuing means by which the bombload and range of an aircraft may be increased. Mayo saw his composite aircraft concept as an ideal way by which this could be achieved.

Mayo had worked almost exclusively on civilian aircraft matters, but he was well known



One of a number of illustrations accompanying Robert Mayo's British patent for a composite aircraft, dated April 27, 1933. A patent was granted in the USA in July 1935, the document stating that it was for "a means for launching aircraft, the particular purpose . . . being to enable an aircraft to be launched at such speed and at such altitude as to ensure the safe continuation of its flight, without its first having to attain the necessary minimum flying speed by taxying over land or water".

VIA AUTHOR

within aviation circles and had Air Ministry connections, so it is likely that he was aware of the broad details of military aircraft specifications issued by the Ministry. He would probably have known that two Specifications for bombers had been issued in late 1932 and early 1933, both conforming to the empty-weight restriction as proposed in Geneva.

Issued in September 1932, Specification B.9/32 was for a twin-engined monoplane medium bomber to replace the Sidestrand, with the ability to carry up to 1,650lb (750kg) of bombs with a range of 720 miles (1,160km). The other Specification, P.27/32, was for a single-engined monoplane bomber to replace the Hawker Hart, to be capable of carrying a 1,000lb (455kg) bombload over 1,000 miles (1,610km) while cruising at more than 200 m.p.h. (320km/h). Mayo's proposed aircraft would be smaller than the latter, carry a heavier load than the former and have a range far superior to either.

In order to assess the feasibility of the concept Mayo drew up a draft specification for a high-speed long-range bomber as the upper component of a composite aircraft. The draft specification stipulated the following challenging requirements:

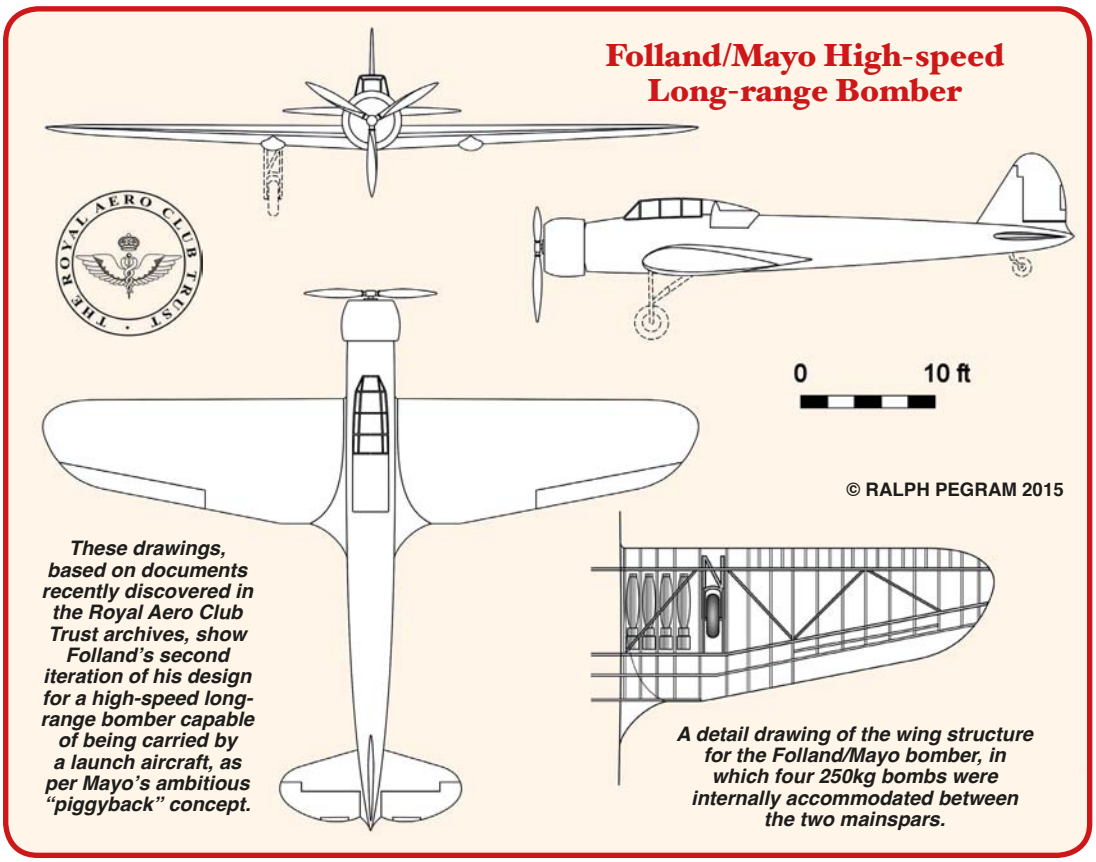
- a bombload of 2,000lb (905kg):
- a range of 2,000 miles (3,220km);
- a cruising speed at full load of at least 200 m.p.h. (320km/h);
- a crew of two;
- an armament of two machine-guns plus 1,000 rounds of ammunition.

This document was issued by the Mayo Composite Aircraft Co Ltd in mid-1935. It is not known which other aircraft manufacturers Mayo approached, but we do know a copy landed on the desk of Henry Folland at Gloster Aircraft, and it is presumably no coincidence that Gloster's Managing Director, Hugh Burroughes, was also a director of Mayo's company.

When Folland received Mayo's draft specification he had his rejected P.27/32 bomber design *[as covered in the second part of this series, in* TAH10 *— Ed]* readily to hand and was deep into the detailed design phase of the F.5/34 fighter; both aircraft incorporated useful ideas for the draft. This was a private specification, not issued by the Air Ministry, and Folland appears

TAH ARCHIVE

ABOVE ***The first of Gloster's monoplane fighters to fly and the last of Folland's designs for the company, the F.5/34 made its first flight in December 1937. Only two prototypes were built; K5604, as seen here, and K8089, which first flew in March 1938, by which time Sydney Camm's superior Hurricane was already in squadron service.***



These drawings, based on documents recently discovered in the Royal Aero Club Trust archives, show Folland's second iteration of his design for a high-speed long-range bomber capable of being carried by a launch aircraft, as per Mayo's ambitious "piggyback" concept.

A detail drawing of the wing structure for the Folland/Mayo bomber, in which four 250kg bombs were internally accommodated between the two mainspars.

to have undertaken the design personally, as his name alone appears on the drawings, which do not carry official Gloster drawing numbers.

Folland set about producing some preliminary sketches. The fuselage for the new bomber was a metal monocoque of elliptical section with a tubular steel engine-mount in the nose. The pilot and gunner were placed back-to-back in the fuselage spine and isolated from one another by the placement of a large 432gal (1,963lit) fuel tank located mid-fuselage. The gunner operated a single Browning machine-gun on a Nash & Thompson servo-operated mount and the pilot operated a fixed Browning in the nose.

The fixed tail surfaces were metal-skinned while the rudder and elevators were covered in fabric. Folland calculated that a wing loading of 38lb/ft² (186kg/m²) was most suitable for the aircraft so the wing had an area of just 310ft² (28m²). It was built on twin full-span spars and was in two parts; the inner parallel-chord section housed the internal bomb racks for four 250lb (110kg) bombs on each side, while the outer section was tapered with rounded tips.

Folland selected the NACA 2200 series aerofoil, which tapered from 18 per cent thickness at the root to nine per cent at the tip, as per the F.5/34 fighter. The entire leading edge, back to the front spar, was skinned with magnesium, while the rear portion was skinned with alloy for the centre section and with fabric outboard. The mainwheels were designed to retract outwards into the wing and the tailwheel retracted into the tail. The bomber was to be powered by a 950 h.p. nine-cylinder Bristol Pegasus X radial engine in a wide-chord NACA cowling, with a fixed-pitch three-bladed metal propeller. Folland submitted this design to Mayo on November 5, 1935.

THINKING . . . AND RETHINKING

Having sent the tender document, Folland had something of a rethink and, just three weeks later, sent a revised design. The fuselage was reduced in height by removing the dorsal spine and the crew's separate canopies were combined, which improved the all-round field of view. The wing was modified so that the leading edge was straight and the two spars linked by cross-bracing. The undercarriage was replaced by a version similar to that on the F.5/34 fighter. It retracted rearwards into fairings that left the lower half of the wheels exposed, a feature designed to minimise damage to the airframe in the event of a wheels-up landing. It is also significant that the prescribed range had increased to 2,500 miles (4,025km), presumably at the request of Mayo. The mission profile was based on a cruising height of just 6,000ft (1,830m); very low for a bomber.

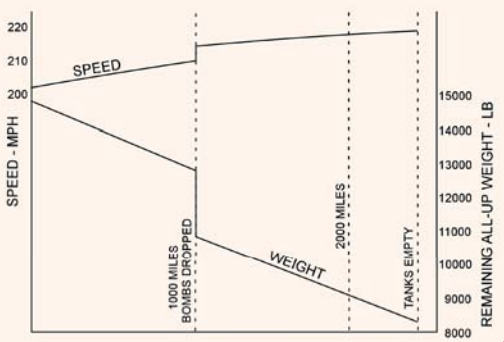
ABOVE ***The author's three-dimensional rendering based on Folland's drawings for a high-speed long-range bomber to be used as part of a "piggyback" bomber concept devised by Folland and Robert Mayo. It appears that the drawings were made speculatively on Folland's own initiative, as only his name appears on the documents.***

Folland/Mayo High-speed Long-range Bomber data

Span	49ft 3in	(15m)
Length (overall)	41ft 0in	(12·5m)
Height (overall)	10ft 3in	(3·1m)
Mean chord	8ft 4½in	(2·5m)
Dihedral	2° 30'	
Angle of incidence	1°	
Aerofoil section	NACA 2218–2209	
Wing area	350ft²	(32·5m²)
Wing loading	42·25lb/ft²	(206kg/m²)
Aileron area	2 x 17·5ft²	(2 x 1·6m²)
Tailplane and elevator area (total)	47ft²	(4·4m²)
Fin and rudder area (total)	24ft²	(2·2m²)
Wheel track	14ft 9in	(4·5m)
Maximum cross-sectional area of fuselage	27·5ft²	(2·55m²)

Mission profile

The data below represents a standard sortie cruising at 15,000ft (4,570m) with the engine set to 2,400 r.p.m.



But this was not to be the end of the story. On June 12, 1936, a third and final tender was issued by Folland. The aircraft layout remained unchanged but there had been an increase in both span and length and a change to the larger 1,200 h.p. Bristol Hercules HE1S 14-cylinder sleeve-valve engine, for which the fuel capacity was raised to 600gal (2,728lit). There were now two guns in the nose and two in the turret. As a consequence of these changes the wing loading had increased to 42lb/ft² (205kg/m²).

Folland provided performance figures for the specified mission. With a full bombload, all guns installed and sufficient fuel for a 2,400-mile (3,860km) sortie, the weight of the aircraft at the point of release from the carrier was 14,800lb (6,710kg). Cruising speed was estimated at 200 m.p.h. (320km/h) at 15,000ft (4,570m), a significant improvement on the previous version of the aircraft — but still low for a bomber. Maximum speed at this point was estimated to be 244 m.p.h. (390km/h) but absolute ceiling only 19,700ft (6,000m).

At the 1,000-mile point, when the bombs were released, estimated performance jumped dramatically. As fuel burned off, the cruising speed rose steadily and reached 215 m.p.h. (345km/h) while maximum speed increased to 250 m.p.h. (400km/h) and absolute ceiling to 27,500ft (8,380m). Performance continued to improve on the return leg and 2,000 miles (3,220km) was reached after a sortie duration of 9½hr. Sufficient fuel remained for a further 2hr, or 400 miles (645km), of flying time. The aircraft's weight on landing was estimated at 8,250lb (3,740kg).

Although these performance figures were far from dramatic they were not unreasonable in the

TAH ARCHIVE

ABOVE ***A possible candidate for the lower component of a piggyback bomber may have been the Armstrong Whitworth Whitley, which, despite its somewhat lumbering appearance, had sufficent performance to be able to undertake the carrier role. This Whitley V, N1532, operated with Nos 77 and 78 Sqns until it ditched in April 1940.***

context of other bombers of the period, although the low absolute ceiling at full load was still cause for concern. Folland had managed to fill the aircraft to capacity — 2,000lb of bombs and four guns — and to fit it into an airframe that was smaller than that of the Fairey Battle, the ultimate winner of a production contract to Specification P.27/32. However, this all came at a price, which Folland noted within the tender. The first caveat was that the landing speed at the end of the sortie — about 75 m.p.h. (120km/h) with the Fowler flaps extended — was higher than normal for an aircraft of this size. While this may have been considered manageable, the second point was of greater concern. Given the high wing-loading at the point of release, the rate of climb was very low, around 315ft/min (96m/min) at 15,000ft (4,570m). From this, Folland concluded that it would not be feasible to release the bomber below at least 10,000ft (3,000m) or at a speed below 180 m.p.h. (290km/h).

Mayo had not specified the performance of the carrier aircraft, but, on the grounds of economy, it is likely that he intended to employ an aircraft currently in service rather than to construct a dedicated carrier. By the nature of Mayo's composite aircraft layout and the weight of Folland's loaded bomber this would have required a large multi-engined monoplane and, most probably, given the size and weight, a heavy bomber. Choice was somewhat limited but a plausible candidate could have been the Armstrong Whitworth Whitley. A re-engined version of the Whitley's civil counterpart, the Ensign, had been suggested as the carrier aircraft for part of Imperial Airways' proposed air mail

Specification P.27/32, to which Folland was broadly working for his piggyback bomber, ultimately resulted in a production contract for the similar but slightly larger Fairey Battle, which entered RAF service in May 1937.

TAH ARCHIVE

VIA AUTHOR

LEFT ***"What Folland did years ago, people are doing today" — this 1939 advertisement for Folland Aircraft Ltd, formed after Folland left Gloster in 1937, capitalises on the perception of Folland as the designer of highly advanced aircraft by using his Gloster VI floatplane, built for the 1929 Schneider Trophy.***

BELOW ***When Specification F.9/37 was issued in September 1937, Folland's replacement at Gloster, George Carter, dusted off his predecessor's design to F.34/35 (as covered in* TAH10*) which, with a number of revisions, became the G.39.***

service. Folland's launch criteria for the bomber would have proven a challenge; the *Maia* and *Mercury* components of the Mayo composite were designed to separate at lower altitude and at a much lower speed.

THE FINAL STRAW

Folland's bomber was unlike any design considered for RAF service at the time. It did not fit within any of the familiar light, medium or heavy categories and the combination of a heavy load and extreme long range could not be met by any other design. The value of such an aircraft in RAF service would have depended entirely on the identification of strategically important targets beyond the reach of the main bomber force.

Whether Mayo attempted to interest the Air Ministry in Folland's bomber remains, alas, unknown. He had, however, drafted a memorandum on military applications of the composite aircraft in January 1936 which implied that speeds of up to 300 m.p.h. (480km/h) and range of up to 3,000 miles (4,800km) could readily be achievable, which Folland had shown to be unlikely for a single-engined aircraft. Mayo also made several attempts to market the composite aircraft concept overseas, including in Germany, but without success. In the early years of the war there were tentative proposals to carry Hurricane and Spitfire fighters to altitude mounted on

TAH ARCHIVE

Consolidated Liberator or Whitley bombers, on which Mayo was asked to comment, but the idea was not pursued.

In the late 1930s aircraft technology developed at a staggering pace and many aircraft in service at the outbreak of war, perceived as class leaders when designed just a few years earlier, proved to be inadequate and highly vulnerable to attack. Single-engined bombers, such as the Battle and Vickers Wellesley, were soon proven to be easy prey for enemy fighters, even biplanes, and their defensive armament far too weak. These aircraft were withdrawn from front-line service in the first few months. Folland's bomber would have fared no better, cruising at just 15,000ft and effectively unmanœuvrable while carrying its bombload, it would have stood little chance. With the bombs dropped it was hardly any better off, outpaced and outgunned by a wide margin.

Folland's dissatisfaction with Hawker Aircraft's management of Gloster's design department came to a head in mid-1936 when he established a private company, Folland Aircraft Ltd, thereby effectively severing his relationship with Gloster. He remained, on paper at least, as Chief Engineer and Designer until the end of the year when he was replaced officially by George Carter.

In early 1937 Folland joined forces with the relaunched and refinanced British Marine Aircraft Ltd at Hamble, with which he became a director. Howard Preston quit his position at Gloster to follow his longtime friend and became Chief Designer. In December the new company changed its name to Folland Aircraft Ltd.

This series of three articles has aimed to dispel the myth that Henry Folland was a conservative designer, unwilling to abandon biplanes and designing by slow, careful evolution. In truth his work kept pace with the changing technology of his time and with the designs of his peers. There was no fundamental problem with the designs he prepared, rather it was the financial weakness of Gloster in the early 1930s, the paucity of sales opportunities — and an element of bad luck — which combined to frustrate his attempts to win contracts. Folland Aircraft made an invaluable contribution to wartime production with sub-contract work, but no more of Folland's designs were built and he retired in 1951.

ABOVE ***Henry Folland with ever-present pipe in hand. Sir Roy Fedden, Bristol's engine genius, said of him: "He had the great gift of leadership and was a very kind and human man. He inspired loyalty and friendship among his staff but could be difficult and terse with those outside". Folland died in September 1954.***

What Henry did next — the first aircraft to be built by the newly-established Folland Aircraft Ltd was the Fo.108 (known affectionately as the "Frightful"), designed to Specification 43/37 for an engine-test airframe. In total, 12 were built; this example, P1778, is seen at Hatfield in 1946, fitted with a close-cowled Napier Sabre.

PHILIP JARRETT COLLECTION

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 103, NUMBER 8

THE 1914 TESTS OF THE LANGLEY "AERODROME"

POLITICALLY INCORRECT

In 1914 the USA's Smithsonian Institution was in dire need of a success story to mitigate the dismal failure of Samuel Langley's Aerodrome in 1903, which it had partly financed. If the machine could be coaxed into the air, it would restore "The Smith's" prestige and vindicate Langley. Enter Glenn Curtiss, who had his own reasons to want to see the Aerodrome fly. Using new artworks, NICK ENGLER reveals the full extent of the radical modifications made to the Aerodrome in 1914 and explores aviation's first big controversy

(PUBLICATION 3699)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION

PHILIP JARRETT COLLECTION

LEFT ***Samuel Pierpoint Langley (1834–1906) was one of America's most distinguished scientists. Having become the Director of the Allegheny Observatory in 1867, he went on to become the third Secretary of the Smithsonian Institution in Washington DC in 1887. The first of Langley's Aerodromes to make a significant flight was the unmanned Aerodrome No 5 in May 1896.***

THE SPINDLY MACHINE perched like a giant dragonfly on the edge of Lake Keuka, surrounded by journalists, photographers and even a videographer. Members of the scientific elite and Washington DC power structure were also there, among them Charles Doolittle Walcott, Secretary of the Smithsonian Institution, and Albert Zahm, the Director of the recently reopened Langley Aerodynamical Laboratory. They carefully spun the event for the media, explaining why they were attempting to fly Samuel Langley's infamous 1903 aircraft — named the Aerodrome — as morning dawned on May 28, 1914, nearly 11 years after two highly-publicised, unsuccessful and nearly-catastrophic attempts to launch it.

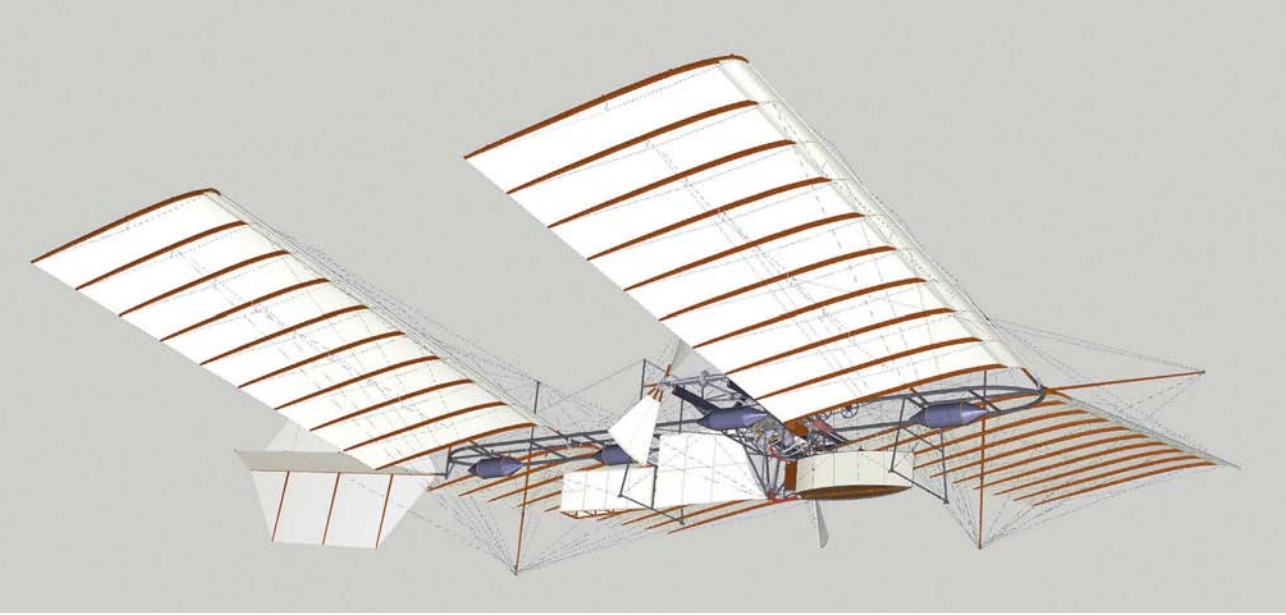
It was time to go. As a cool breeze rocked the tandem wings that sprouted from the Aerodrome, workmen from the Curtiss Aeroplane & Motor Co of Hammondsport, New York, lined up along the pontoons and outriggers recently added to the airframe. They lifted the half-ton aircraft a foot or so above the ramp, duck-walked it into the water and turned it into the wind.

Glenn Curtiss settled into the cockpit and tested the familiar Curtiss controls; wheel, post and shoulder-yoke borrowed from one of his early pushers. This system had replaced the dual trimwheels originally intended to steer the Aerodrome. Workmen swung the twin propellers and the old Manly-Balzer engine sprang to life — or as much life as it had left. It had been damaged by age or carelessness and only produced two-thirds of the 52 b.h.p. it had generated in 1903. To compensate, Curtiss had added a new carburettor and high-tension magneto ignition. He had also re-shaped the propellers to increase the thrust. He hoped it would be enough.

Curtiss advanced the throttle and the machine moved forward. The wings fluttered a little but showed none of the elasticity that had plagued the 1903 flight attempts. Curtiss had replaced Langley's flimsy hollow-core ribs with pieces of

BELOW ***Meddling with history — Curtiss engineers work on the first-stage reconstruction of the Langley Aerodrome at Hammondsport in 1914. The original 1903 Aerodrome had no undercarriage, unlike the reconstruction, which sported pontoons as seen here, and was considerably flimsier than its 1914 iteration.***

PHILIP JARRETT COLLECTION

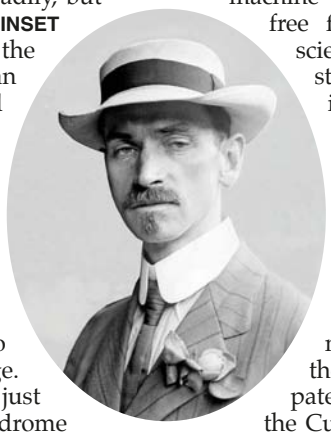


ARTWORKS BY NICK ENGLER/WRIGHT BROTHERS AEROPLANE COMPANY

ABOVE ***The Langley Aerodrome in its original 1903 configuration. This is the first of three detailed artworks by the author, showing the 1903 and 1914 versions of the Aerodrome, plus a composite which highlights the differences. All three are available as free interactive downloadable 3D PDFs via our website at www.theaviationhistorian.com.***

solid wood, laminated to hold the camber. He had also doubled-up on the spars and replaced the slender guy posts (to which the wing rigging was attached) with sturdy A-frames, repositioning them to coincide better with the centre of pressure (c.p.). All of this, combined with the bracing between the wings and the pontoons, greatly strengthened the airframe.

The Aerodrome gained speed steadily, but painfully slowly. Curtiss (seen **INSET RIGHT** in 1909) was well out on the lake when the aircraft finally began to dance on the waves. He pulled back on the wheel, praying there was enough lift. In rebuilding the wings, he had altered the camber from a deep 1/16 to a gentler 1/28. He had done this by shortening the ribs, eliminating a section of each wing forward of its leading spar. This also narrowed the chord, raised the aspect ratio and created a rounded leading edge. The lift was increased, if only just enough. The reconstructed Aerodrome left the surface of Lake Keuka for a little over 3sec and travelled 150ft (46m) through the air. It wasn't much, but it was a flight.



Walcott and Zahm were effusive. However short, they declared, this hop-flight vindicated the aircraft's inventor. If Langley's Aerodrome was flyable now, it could have flown in 1903, they averred. The media dutifully printed photographs showing a little daylight between the pontoons and the water, along with Walcott's and Zahm's pronouncements. According to the June 6, 1914, edition of *Scientific American*:

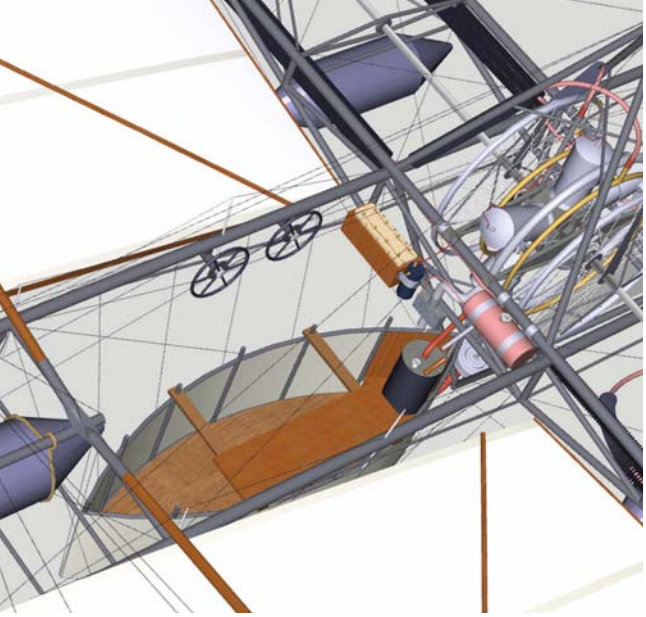
"The machine and its engine had been shipped from the Smithsonian Institution to the Curtiss factory in early April and was reclothed without change of size or shape. The framing, the engine, propellers, wings, rudders, and controls are, therefore, just as Langley left them.

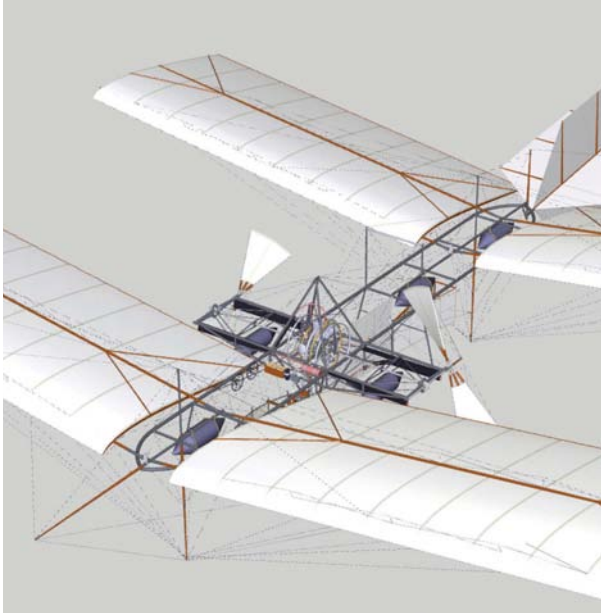
"The brief successful flight of May 28 proved that Langley's invention had been the first machine in history capable of prolonged free flight with a passenger. A great scientist and inventor, misunderstood and persecuted in his lifetime, is vindicated."

Wright vs Curtiss

Zahm and Walcott's distortion of the 1914 test flights and the unwarranted assertion that the Langley Aerodrome was airworthy in its 1903 configuration was repeated in hundreds of newspapers and magazines around the world. The Wrights' English patent attorney, Griffith Brewer, visited the Curtiss camp on Lake Keuka in mid-June, took some photographs to document the changes that had been made to the Aerodrome, and on June 22, 1914, fired off a letter to *The New York Times* that exposed the deception. This, in turn, generated a controversy that raged for nearly 30 years. Instead of vindicating Langley, it eventually wedded his name to a failure that overshadowed his many successes and diminished the scientific institution he had once led.

The media were quick to understand why Curtiss had staged this event. In 1909 the Wright brothers had filed a suit against his firm for patent





ABOVE LEFT ***Looking down into the cockpit "boat" from a viewpoint just above the 1903 Aerodrome, this image shows the twin-"trimwheel" controls, and the original ignition system. ABOVE RIGHT This front three-quarter view of the 1903 version shows the frail kingpost bracing system and the original helical propeller-blade shape.***

infringement. The Wright brothers and Curtiss had been duking it out in the courts ever since, the Wrights winning each round. Curtiss had just lost his last possible appeal. He was on the ropes; the continued existence of the Curtiss Aeroplane & Motor Co was in doubt unless he could come up with a good reason to reopen the case. On June 5, 1914, *Flight* magazine in the UK had observed, "This test has a purpose in view, besides vindicating Langley. It is held that by this proof of the capability of the Langley machine to fly, certain patent claims can be successfully overcome".

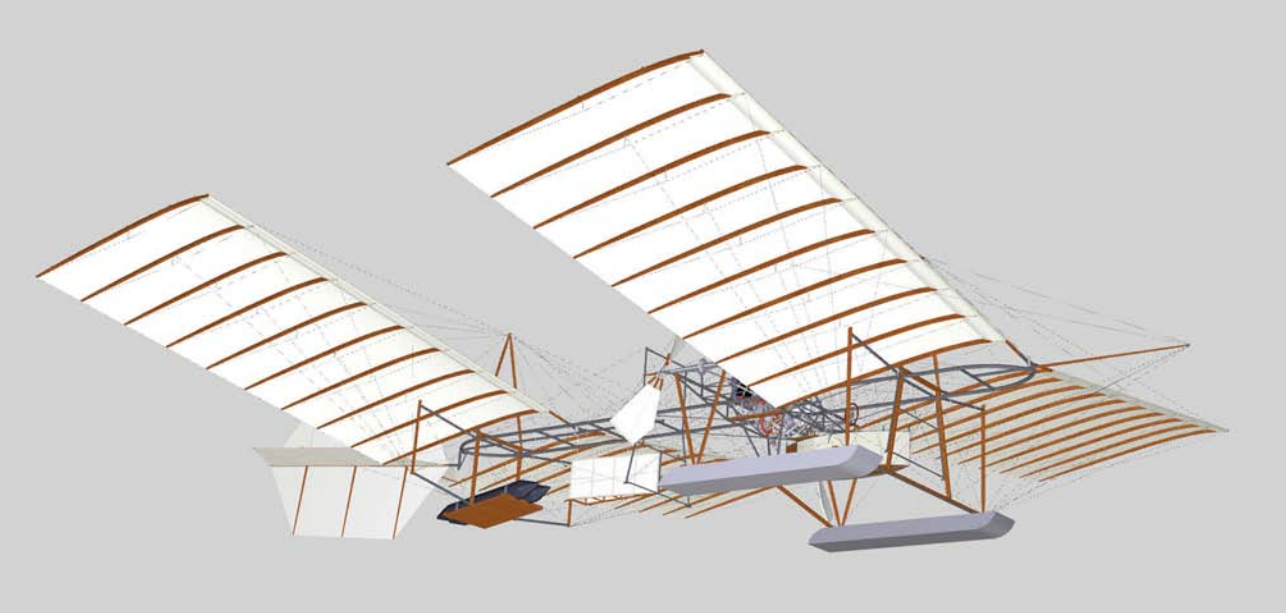
The motives of the Smithsonian Institution were less clear. The Aerodrome was a technological dead end; the few unmanned aerodromes that Langley had successfully flown in the late 1890s did not influence the development of aeronautics except to inspire a few early aviators, among them the Wright brothers. Why had Secretary Walcott and the Smithsonian risked their reputations by revisiting a failed experiment just to vindicate a dead colleague?

The question was its own answer. Reputation was the coin of the realm in Washington DC, then as it is now. The stated purpose of the Smithsonian may have been to advance and share scientific knowledge, but it existed in a city that ran on politics. Walcott may have been an accomplished palæontologist, but he was also a highly effective politician — one that had carefully groomed his reputation. He had just one outstanding blemish that limited his potency in his current position; the failure of the Langley Aerodrome.

Walcott had been involved with the manned Aerodrome since its inception in 1898. By that time he had earned the reputation of a political dynamo around Washington. Walcott had taken over the ailing United States Geological Survey (USGS) in 1894 and in four years had doubled its size and responsibilities. In the process he had also cultivated many useful friendships around town and was on first-name terms with President William McKinley.

In 1897 George Brown Goode, the Assistant Secretary of the Smithsonian Institution, died unexpectedly. "The Smith" keenly felt his loss. Goode was the Smithsonian's best political asset; he had been put in charge of the National Museum and was being groomed for the top position. Secretary Samuel Pierpoint Langley, who had been in charge since 1887, was a popular figurehead. Every American was thankful to him for making the railroads run on time; he instituted time zones and telegraphed accurate time data based on astronomical observations. His subsequent discovery of sunspots and exciting experiments with unmanned flying machines had kept him in the news and made the Smithsonian a household word. But his micromanagement and autocratic airs limited his effectiveness as a leader, and his reclusiveness and aversion to publicity diminished him politically. With Goode gone, the Smith was in trouble.

The Smithsonian Board of Regents offered the Assistant Secretary position to Walcott, knowing he was one of the few that could fill Goode's shoes. He wouldn't even have to move; the USGS offices were in the Smithsonian's overcrowded National Museum building. After much cajoling, Walcott agreed to take on the position in addition to his USGS duties only until another suitable candidate could be found. Once in the saddle he attacked the problems he saw with characteristic energy and immediately began reorganising the



ARTWORKS BY NICK ENGLER/WRIGHT BROTHERS AEROPLANE COMPANY

ABOVE ***Looking at first glance very similar to the 1903 Aerodrome, except for the floats, this artwork shows the aircraft in its May—June 1914 configuration, with revised bracing, narrower-chord wings, pontoons, reinforced spars and ribs and other changes including the propeller blades, reshaped in an effort to increase thrust.***

museum, instituting an administrative system that lasts to this day.

The Smithsonian of 1897 was not the powerhouse that now dominates the Mall in the centre of Washington DC. It had been ignored and underfunded by Congress since its inception in 1846. Its central building, nicknamed "The Castle", was built in 1855. The National Museum Building was built nearby in 1881, mostly to house exhibits left over from the 1876 Centennial International Exposition of Philadelphia — the first World's Fair. By the end of the 19th Century the Smithsonian was crippled by a lack of space. Langley had added a zoological park, the National Zoo, in 1889, but that had done nothing to alleviate the overcrowding.

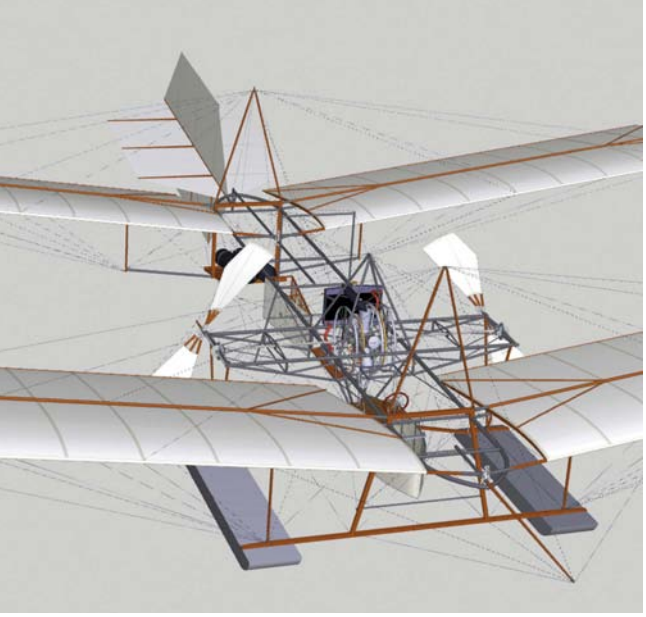
Langley's "secret mission"

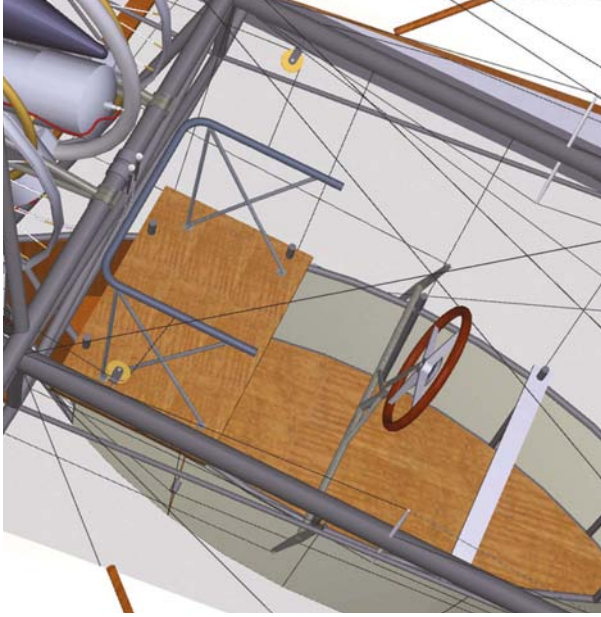
Walcott (seen at **RIGHT** in 1907) was well aware that the Smithsonian needed to expand, and was equally aware that it needed the support of Congress to do so. It occurred to him that a big win for the Smith would attract political support. In February 1898, events conspired to produce that win. The explosion of the warship *USS Maine* in Havana Harbor prompted the American military to inventory its weapons as war with Spain became imminent.

A few weeks later Walcott bumped into Langley in his workshop and discussed the possibility of adapting Langley's aerodrome design to carry a man. The two agreed that such a thing could be of great service to America at war. Walcott took the idea to President McKinley, who suggested he talk to Assistant Secretary of the Navy Theodore Roosevelt, who penned a memo to other members of the War Department. It

read: "The machine has worked. It seems to me worthwhile for this government to try, whether or not it will work on a large enough scale to be of use in the event of war". More meetings and memos followed, and by November 1898 the US Army had assigned Langley a "secret mission" to develop a manned aircraft for the Spanish-American War. It agreed to fund the programme for $50,000 — half in 1898 and the remaining $25,000 in 1899 if sufficient progress was made.

This was an earth-shaking accomplishment. The War Department's Board of Ordnance, which provided the money, had never before invested in the development of a technology. In getting it to fund a speculative experiment, Langley — with Walcott's assistance — had moved a mountain.





ABOVE LEFT ***Rotating the 3D artwork of the 1914 version to a more frontal view reveals the sturdy A-frame wing struts and associated float struttery.*** **ABOVE RIGHT** ***The 1914 cockpit. Note the conventional wheel for pitch and yaw control; the pilot would use a Curtiss shoulder-yoke for roll control, hence the seat-rail for him to bear against.***

This achievement had its desired effect. In 1902, while Langley's star was still on the rise, Congress agreed to erect a new building for the National Museum, directly across the Mall from the Smithsonian Castle.

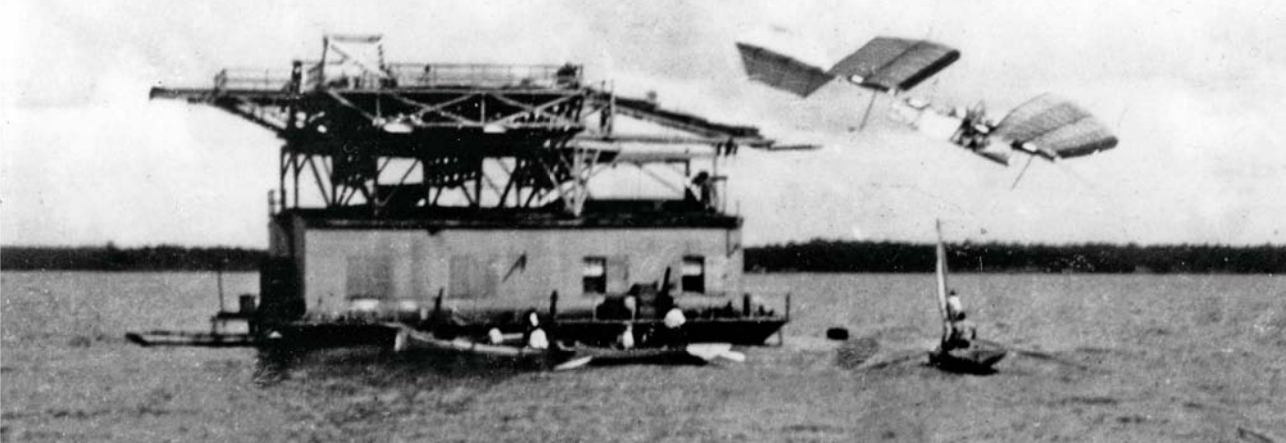
On June 30, 1898, Walcott went back to the USGS full time. But with his offices in the National Museum building, Walcott was never very far away from the goings-on at the Smith. He shared in the triumph when the new museum building was funded, but was heartbroken in 1903 when the Aerodrome twice failed to fly. On October 7 and December 8, 1903, the aircraft was catapulted from the top of a houseboat with would-be pilot Charles Manly aboard, and both times it simply dropped into the Potomac River.

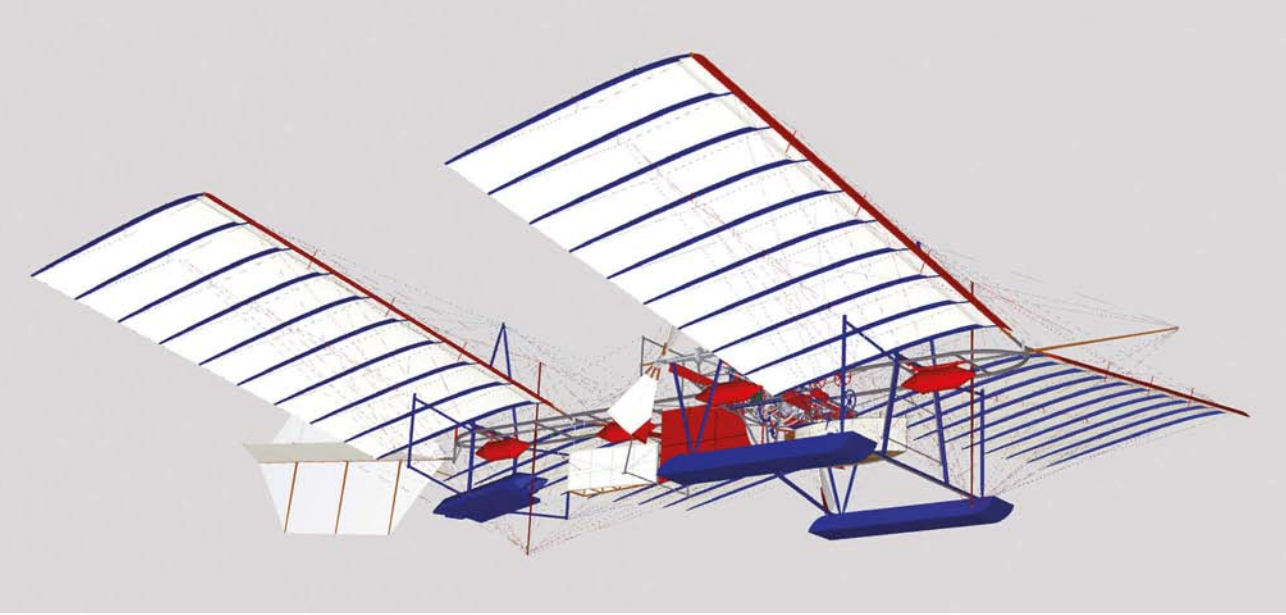
Langley insisted that the Aerodrome was airworthy; the fault was in the launching mechanism. The craft had caught on something as it was flung into the air. This was an experiment; he was close to the solution, he just needed more money to continue the tests until he surmounted the launch problem. He had applied for an additional $25,000 in September 1903, but, after the second failure, the Army declined. The remains of the Aerodrome were deposited at the Smithsonian in case Langley wanted to continue the tests on his own dime. Privately, several members of the Army said they would like to see further tests. Publically the Army was much more critical, as was Congress and the media. Walcott was appalled as Langley was lampooned again and again in the newspapers and on the floors of Congress. This, after all, affected his own reputation as well as Langley's.

Samuel Langley died on February 26, 1906, leaving the Smithsonian with its reputation at a low ebb. Not only had it suffered the embarrassment of the failed Aerodrome, there had been problems with the new building. Work was

Two separate attempts were made to launch the original Aerodrome from a houseboat in 1903 — the first on October 7 and the second on December 8 (only nine days before the Wright brothers' famous flights at Kitty Hawk) — both of which concluded with the machine suffering structural failure and fluttering into the Potomac River.

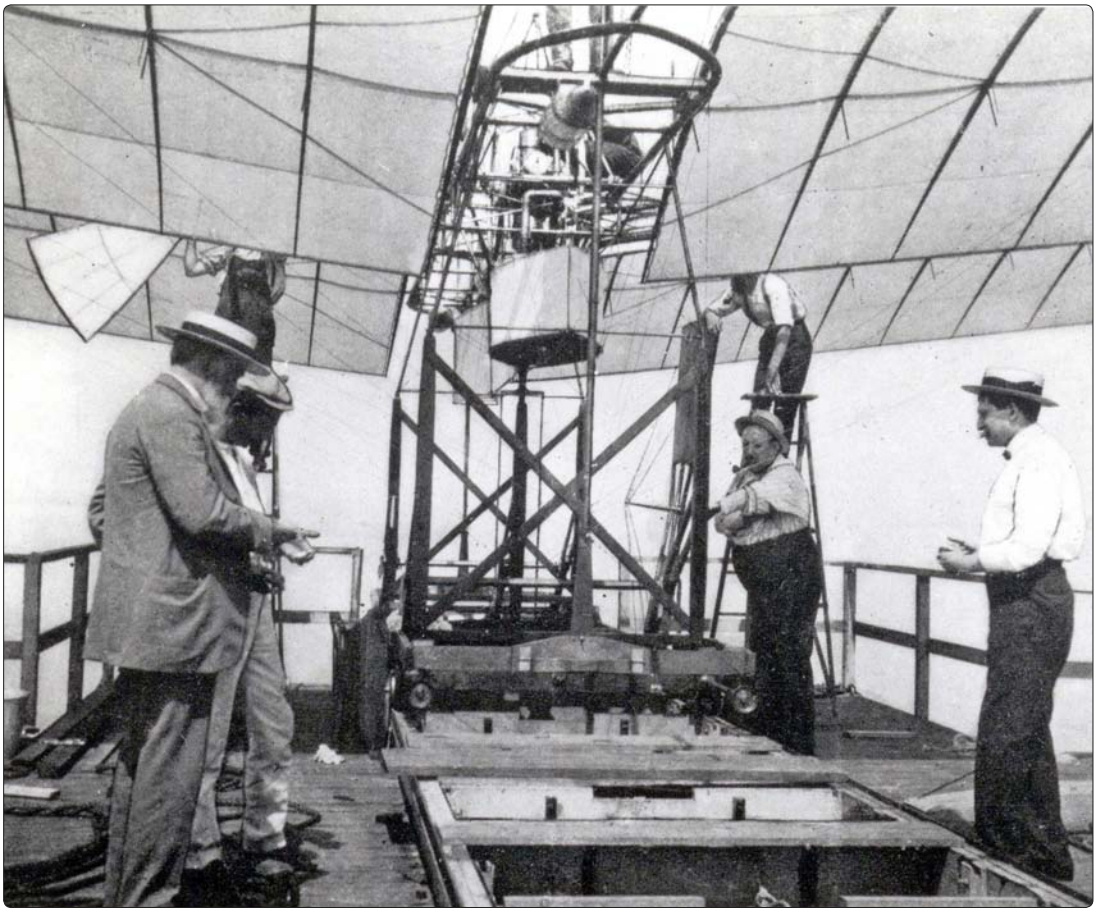
PHILIP JARRETT COLLECTION





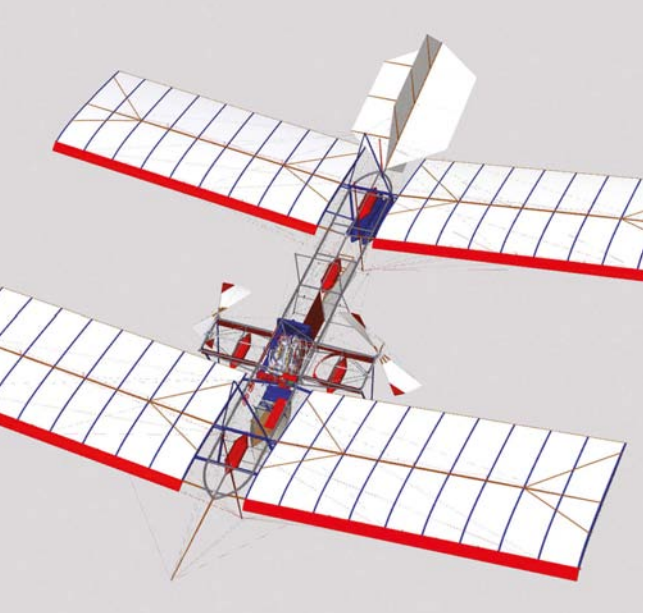
ARTWORKS BY NICK ENGLER/WRIGHT BROTHERS AEROPLANE COMPANY

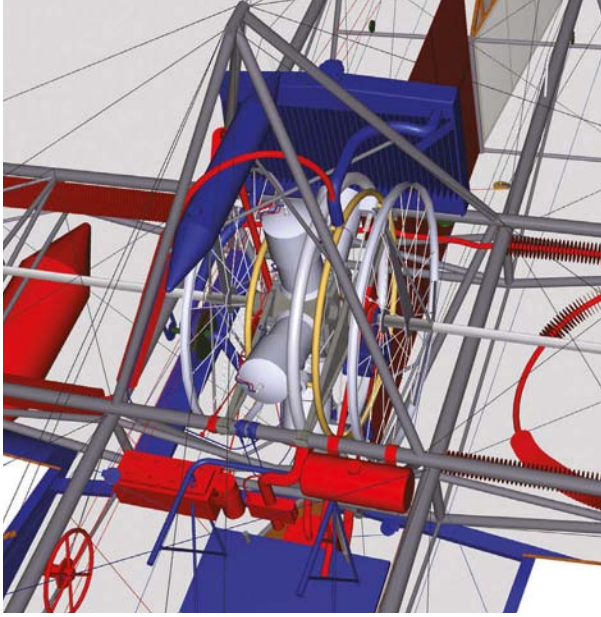
ABOVE ***In this composite artwork, the parts of the Aerodrome that were removed in 1914 are shown in red and those that were added or modified are shown in blue. Apart from the addition of the pontoon floats replacing the original small flotation-aid tanks, note especially the deletion of the 19ft² (1·76m²) central fabric "keel" surface.***



PHILIP JARRETT COLLECTION

ABOVE ***Samuel Langley (furthest left) supervises preparations for the launch of the original Aerodrome from the roof of a houseboat in 1903. Despite both attempts ending in a dunking for the pilot, Charles Manly, Langley continued to insist that the aircraft was airworthy, but had failed owing to a defect in the launching apparatus.***





ABOVE LEFT ***The truncation of the wing leading edges (seen in red) increased the aspect ratio and reduced the camber.*** **ABOVE RIGHT** ***Zooming in on the Manly-Balzer engine installation shows how the finned-tube radiators were replaced by a more conventional unit. Download all these 3D artworks from our website to explore them fully.***

halted in 1905 as its ornate baroque design was exchanged for a simpler dome and columns.

The same year, the Smithsonian's accountant, W.W. Karr, was found with his hands in the till. And towards the end of 1905, reports began to surface that a pair of bicycle mechanics from Dayton, Ohio, had developed a practical manned aircraft with no financial resources other than their own earnings. When compared with the $50,000 Langley had spent — $73,000 including money borrowed from internal Smithsonian funds — this was a major embarrassment.

The Board of Regents first offered the Smithsonian's reins to Henry Fairfield Osborn, another administrative genius whose innovative dinosaur displays were drawing crowds. When Osborn declined they turned again to Charles Walcott, who this time accepted the challenge and began to rebuild the Smithsonian's political effectiveness. And part of his plan to do so was to rehabilitate Langley's reputation as a pioneer in aeronautic science.

A point to prove

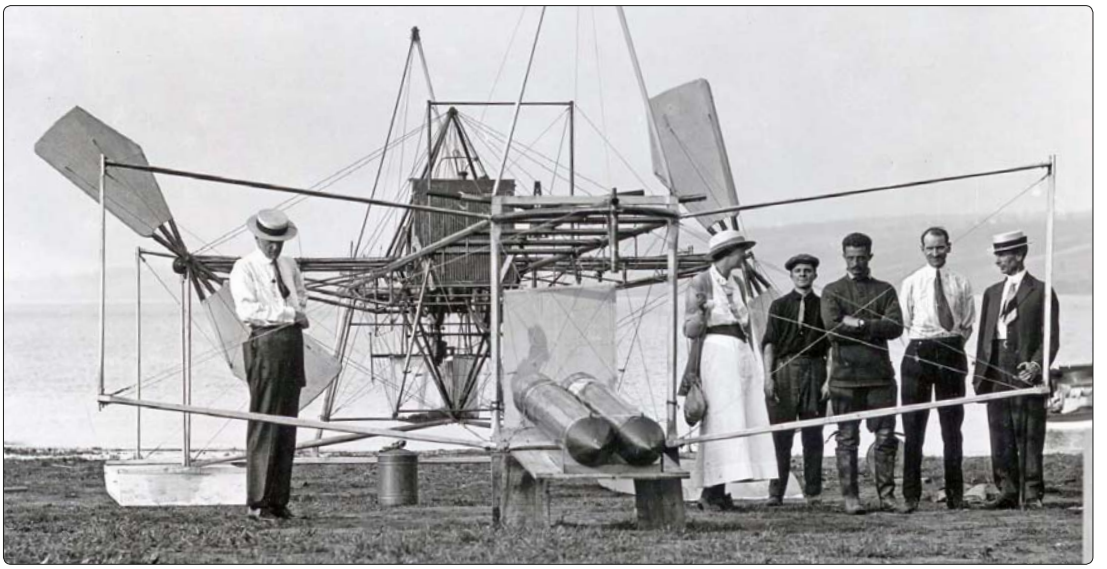
During the years that followed, the Smithsonian published dozens of papers that painted Langley's aeronautical work in a favourable light, including Langley's memoirs, edited by Charles Manly. They instituted the Samuel P. Langley Medal for Aerodromics to recognise contributions to aeronautics and aviation. May 6 was declared "Langley Day", commemorating the first successful flights of his unmanned aerodromes. The Smith unveiled a bronze tablet at the Castle that lionised Langley's contributions to aeronautics. Specifically, it immortalised Langley's discovery of the "relations of speed and angles of inclination to the lifting power of surfaces moving in the air". The effect had actually been discovered by a French artillery officer, Colonel du Chemin, in 1829. Nonetheless, the Langley name slowly recovered.

A NOTE ABOUT THE 3D PDFs

THE COLOUR ARTWORKS illustrating this article have been generated from interactive 3D PDF files created by the author. Readers may download these incredibly detailed files from our website at www.theaviationhisorian.com, and view them using, for example, Adobe Reader X free software. The viewer can rotate, zoom, pan and fly-through the image, exploring the Langley Aerodrome at close quarters and from every possible angle.

In 1911 the drive to rehabilitate Langley was stepped up a notch. At the inaugural banquet of the American Aeronautical Society in New York City, the attendees — Walcott among them — earnestly discussed creating a central aerodynamics laboratory to direct research in this emerging technology. European nations already had similar organisations such as Britain's Advisory Committee for Aeronautics. Proposals were floated in the press and before members of Congress with the US Navy, Massachusetts Institute of Technology, Bureau of Standards and the Smithsonian all vying for control of the proposed institution and its attendant funding.

Soon after, Walcott reopened Langley's workshop at the Smithsonian, contracting Albert Zahm to run it. Zahm was a pioneer in aeronautics, having done extensive windtunnel work at Washington DC's Catholic University in 1901. To give this gesture more substance, on May 23,



PHILIP JARRETT COLLECTION

ABOVE ***Charles Doolittle Walcott (furthest left) contemplates the incomplete Aerodrome at Hammondsport in 1914. Other members of the group include Albert F. Zahm (furthest right), Glenn Curtiss (second from right) and Walcott's daughter Helen. Note the automobile-type radiator which replaced the finned tubes on the 1903 original.***

1913, Walcott convened a committee to direct the workshop, calling it the "Advisory Committee of the Langley Aerodynamical Laboratory". Walcott was the president, Zahm was the recorder and the rest of the committee was peopled with high-profile names in aviation, among them Orville Wright and Glenn Curtiss.

This was bold politics. By reopening the workshop and creating a capable governing body, Walcott told Congress in effect: "Why create a new national laboratory for aerodynamics when we've already got one?" But it didn't work. Walcott's opponents found an obscure law passed a few years earlier that prevented executive agencies such as the Smithsonian "from requesting the heads of departments to permit members of their respective departments to meet at the Institution and serve on an advisory committee". They used this to force Walcott to disband his Advisory Committee. Although Langley's workshop remained open, it no longer had the political status afforded by famous and well-placed advisers.

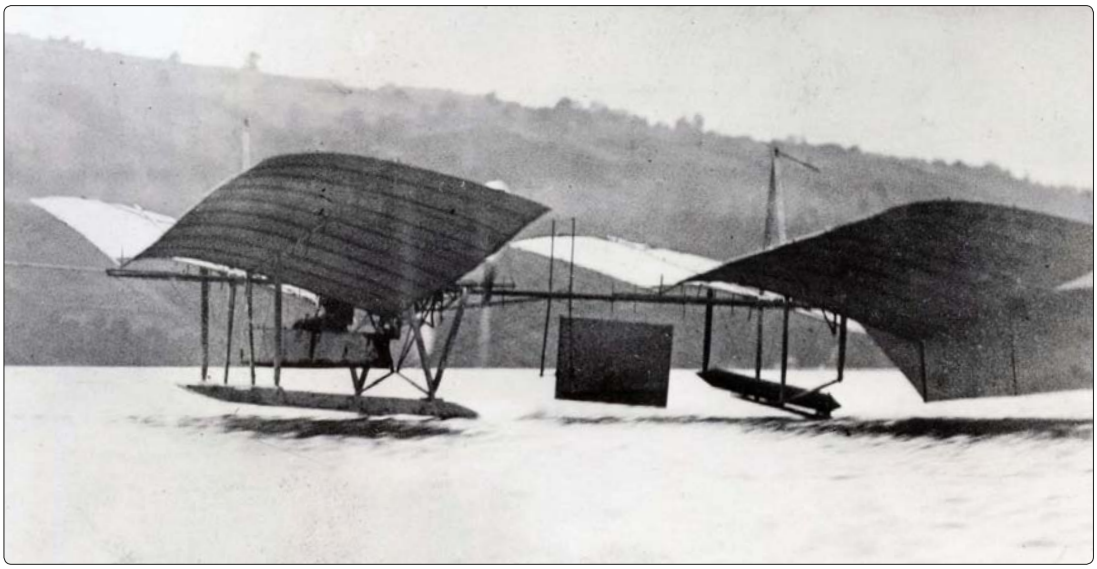
Killing two birds . . .

A new opportunity arose in 1914. In January the US Court of Appeals, Second Circuit, adjudicated the suit involving the Wright brothers' patent for an aircraft control system. Chief Judge Learned Hand declared the patent was entitled to "liberal interpretation", designating it as the "pioneer patent" of the aviation industry. It was an electrifying decision for the aviation community, making it possible for Orville Wright (Wilbur having died in 1912) to create a patent monopoly on the aeroplane, much as Alexander Graham Bell had done with the telephone.

Not long afterwards, Walcott invited Curtiss to bring one of his new flying-boats to Washington DC for Langley Day — May 6, 1914. Curtiss replied that he would rather restore and fly Langley's old Aerodrome. It was not a new idea; similar projects had been suggested beginning in 1906. But in light of the patent case, it took on a new importance. If the Aerodrome flew, not only would it restore Langley's reputation, it would also show that other manned aircraft could have flown before the Wrights — their patent had no right to pioneer status. The threat of a monopoly would vanish and the aircraft industry could rest easy, thanks to the Smithsonian.

There was a series of telephone calls between Walcott, Curtiss and Alexander Graham Bell (a longtime friend of both Langley and Walcott) as the project began to take shape. There would be two separate missions, the first to show that the 1903 Aerodrome was airworthy and could have flown in 1903. The second was to investigate the tandem-wing configuration and see what uses it might have in modern aeronautical engineering. On April 2, 1914, the Smithsonian shipped the Aerodrome airframe to the Curtiss Aeroplane & Motor Co in Hammondsport. It was followed by the original engine several days later. All parties agreed that this project should proceed in confidence, with no announcement. The Smithsonian Board of Regents was never consulted or asked to approve these actions, despite Bell being a member of this board.

In Hammondsport, Curtiss's workmen made the Aerodrome their priority. Charles Manly, who had built the Aerodrome engine, joined the team along with Albert Zahm, who was the Smithsonian's on-site representative. The group strug-



PHILIP JARRETT COLLECTION x 2

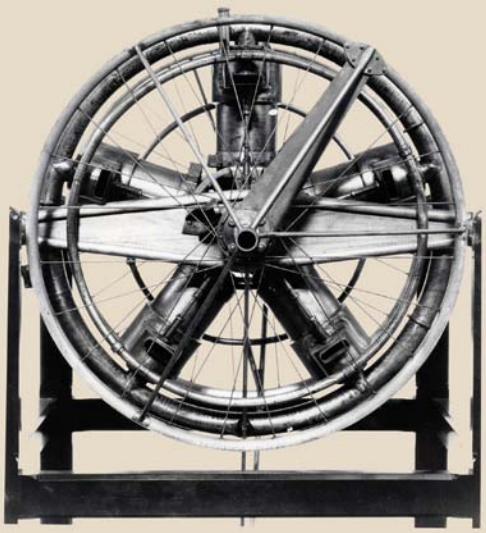
ABOVE ***Showing the merest glimpse of air beneath its pontoons, the much-modified Aerodrome lifts from the surface of Lake Keuka on June 2, 1914, with Glenn Curtiss at the controls. The fixed tail surface was altered to become a movable rudder during the first set of modifications and a large underfuselage rudder was also fitted.***

gled mightily to get the Aerodrome ready for Langley Day, but was plagued by unanticipated problems. The Aerodrome was not as airworthy as the team had been led to believe and changes had to be made. Curtiss was not confident to attempt his first mission — to prove that the Aerodrome might have flown in 1903 — until late May. By this time the Aerodrome was no longer the same aircraft it had been in 1903. But Walcott, Zahm and the Hammondsport team would say that it was close enough to prove the point.

Curtiss made a few straight-ahead hops on May 28, June 2 and June 5, none lasting more than a few seconds. These were not the results he and Walcott had hoped for, but the media had their story and the photographs to support it. Walcott was quick to press the political advantage. On June 11, 1914, House Minority Leader James R. Mann of Illinois read into the Congressional record the results of the Hammondsport trials, and mentioned the need to "provide under some scientific bureau of the Government some means for further investigations and experiments with regard to heavier-than-air machines". Mann intimated that this scientific bureau should be under the direction of the Smithsonian Institution, as suggested by its Secretary. He also mentioned a dollar amount; "$50,000 to continue investigations along the line of aeronautics under the Smithsonian Institution". Nothing was decided, but the point was made.

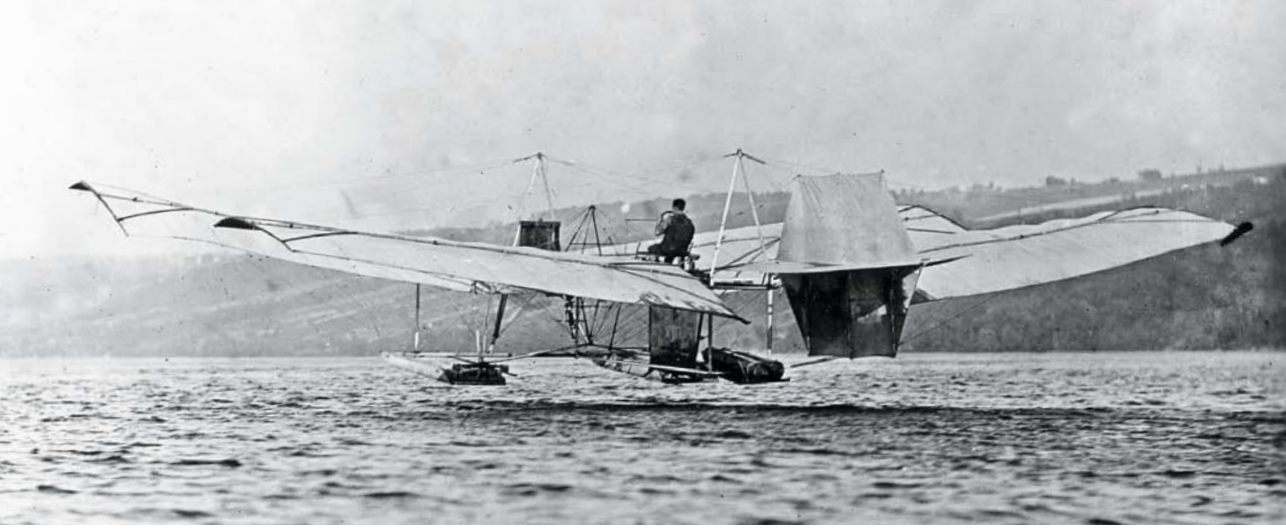
A result ~ of sorts

Late that summer the team began the second part of its mission, to see what value, if any, the tandem-wing configuration might have for modern aeronautics. The tests continued at a



THE MANLY-BALZER ENGINE

BASED ON A design by New York-based engine builder and former Tiffany's watchmaker Stephen Balzer and co-developed with Langley's assistant Charles Manly, the five-cylinder water-cooled radial engine that powered the original 1903 Aerodrome, the world's first purpose-designed aircraft engine, was a remarkable piece of engineering for its day. Originally fitted with a Balzer carburettor consisting of a chamber filled with lumps of porous cellular wood saturated with gasoline, through which air was drawn, the engine was modified for the 1914 flights (as seen **ABOVE**) with an automobile-type carburettor with a float feed. The original radiator, made up of tubes with radiating fins, was also replaced, with a car-type "honeycomb" radiator.



PHILIP JARRETT COLLECTION

ABOVE ***The Aerodrome was modified yet again, even more radically, for more flights from Lake Keuka later in 1914. The pilot's position was completely relocated atop the wings and further aft and, significantly, the original engine and twin pusher propellers were replaced with a modern 80 h.p. Curtiss engine driving a single tractor propeller.***

leisurely rate until November 1915 when Curtiss called a halt. The Aerodrome was dismantled, packed up and returned to the Smithsonian.

The politicking had worked — sort of. On March 3, 1915, Congress created the National Advisory Council for Aeronautics (NACA) "to supervise and direct the scientific study of the problems of flight with a view to their practical solution". It was established as an entity separate from the Smithsonian or any other institution — not exactly what Walcott had wanted. However, Walcott was appointed to NACA's governing council and within a few years he would lead it. And he was eventually able to build an experimental facility with Langley's name, although the Langley Memorial Aeronautical Laboratory ended up in Newport News, Virginia, rather than Washington DC. It was a not-so-classic case of a politician not getting his cake and eating it anyway.

This development also solved Curtiss's problems, although not in the way that he expected. As the First World War progressed and America's participation loomed, the new NACA negotiated a "patent pool" with members of the aviation industry and created the Manufacturers Aircraft Association to administer it, all in the interest of national defence. Manufacturers could use key patents simply by paying reasonable fees into the pool. Curtiss's lawyer, W. Benton Crisp, wrote up the agreement.

The last straw for Orville

Unfortunately, the Hammondsport trials took on a life of their own even after the reasons behind them had expired. In August 1915 Albert Zahm published *The First Man-Carrying Aeroplane Capable of Sustained Free Flight: Langley's Success as a Pioneer in Aviation* in the *Annual Smithsonian Report* for 1914. Similar reports and papers appeared in the *Annual Reports* of 1915–18. The Smith's spin in these articles began appearing in popular magazines, books and encyclopædias.

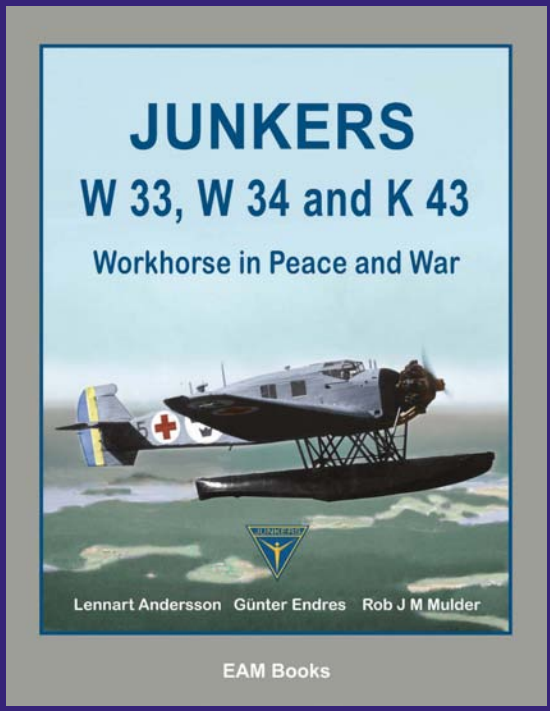
In 1918 the Smithsonian restored the Aerodrome to its original 1903 configuration and hung it in the Arts & Industries Building. The label read: "The first man-carrying aeroplane in the history of the world capable of sustained free flight. Invented, built and tested over the Potomac River by Samuel Pierpont Langley in 1903. Successfully flown at Hammondsport, NY, June 2, 1914".

This was the last straw for Orville Wright, and he began a war with the Smithsonian that he eventually won in the courts of public opinion. At the suggestion of his friend Griffith Brewer, Orville announced his plan to send the restored 1903 Wright Flyer — considered by many Americans to be a national treasure — to the Science Museum in Kensington, England, unless the Smithsonian rescinded its position on the Hammondsport trials. In effect, he ransomed the Flyer for the truth. It was a masterful bit of politics on Wright's part, catching the Smithsonian in a trap of its own making. The Smith could not admit the truth without seeming scurrilous or maintain the fiction without looking foolish. It opted for foolish until 1942 when Secretary Charles Abbott, Walcott's successor, finally owned up to the affair and brought the Flyer home.

THE LANGLEY 1903 & 1914 AERODROME DATA

	1903	1914
Dimensions		
Wingspan	48ft 5in (14·8m)	48ft 5in (14·8m)
Length	52ft 5in (16m)	52ft 5in (16m)
Wing area	1,040ft² (97m²)	988ft² (92m²)
Aspect ratio	1·96:1	2·05:1
Weights		
Total with pilot	850lb (385kg)	1,170lb (530kg)

NEW BOOK:
JUNKERS W 33, W 34 AND K 43
Workhorse in Peace and War



When in 1919, less than a year after the devastation of the First World War, the small six-seat Junkers F 13 made its first flight at Dessau in Germany, few would have predicted that it would soon be serving air routes in most parts of the world. As air transport grew, more power, capacity and range was demanded , and this inevitably led to the development of the F 13 into the W 33/W 34, further expanded with the production of the K 43 military variant, as war clouds once again descended on Europe. A total of more than 2,360 aircraft were produced, many as training aircraft for the Luftwaffe, which demonstrates their unexpected success.

Having produced a book that comprehensively describes the F 13, this follow-on work of its successor continues the authors' more than forty years' fascination with Junkers and represents a natural progression. However, destruction of many records and documents during the war years has made the task of reconstructing the aircraft's history much more difficult, but the wealth of information, photographs, colour drawings, facts and figures, and production list will take the reader on a great journey through aviation history.

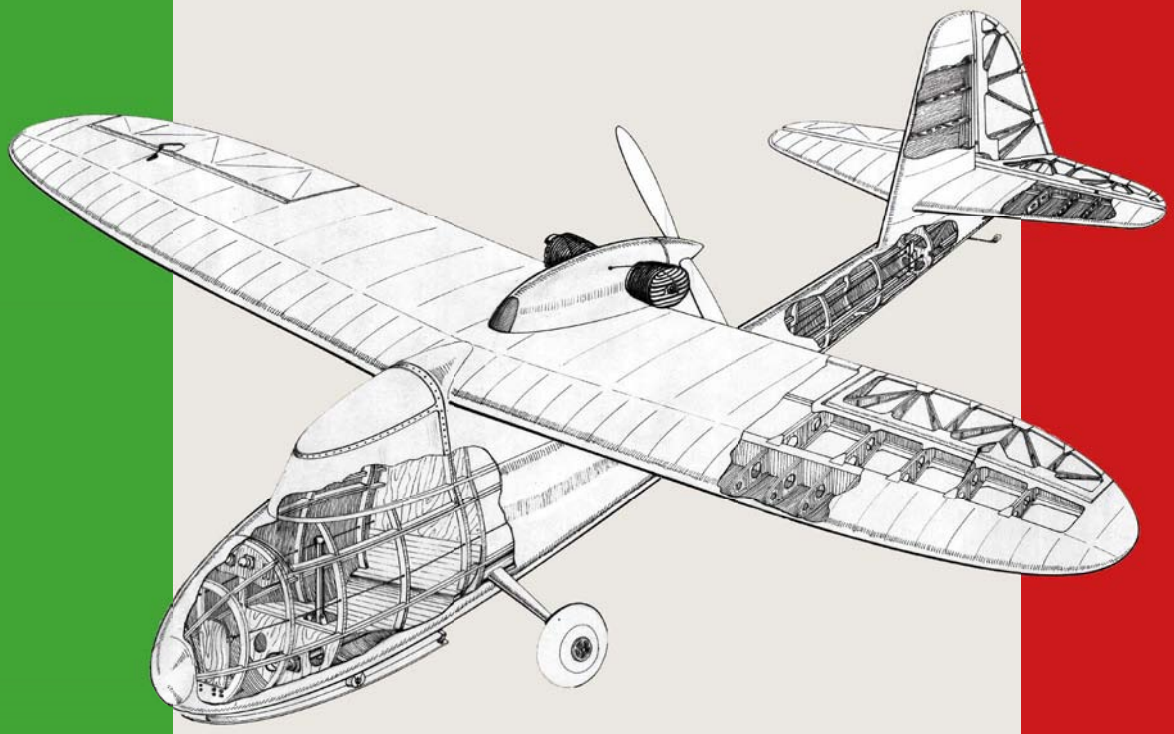
About the book: 21.6 x 27.9 cm, 272 pages, hard covers, 270 b/w photos, five pages of drawings, many tables and full production list. Colour section with profiles and philately appendix.

Prices:

UK:	£ 30.00 including postage
Europe:	£ 35.00 including postage
Rest of world:	£ 44.00 including postage

ORDER YOUR COPY: WWW.EAMBOOKS.COM

GÜNTER ENDRES - LENNART ANDERSSON - ROB MULDER



FRATI'S FIRST FLEDGLING

The Movo F.M.1 Passero

Known chiefly as the designer of some of Italy's most stylish and elegant post-war light aircraft, Stelio Frati began his career with the F.M.1 Passero — or Sparrow — an ultra-lightweight, affordable high-wing single-seater for the week-end flyer. **GREGORY ALEGI** details the history of the first of the maestro's designs to take wing

AUTHOR'S COLLECTION

ABOVE ***A young Stelio Frati with the prototype Ambrosini GF.4 Rondone in its I-RAIA test markings. Frati later earned his wings in his own F.8 Falco.***

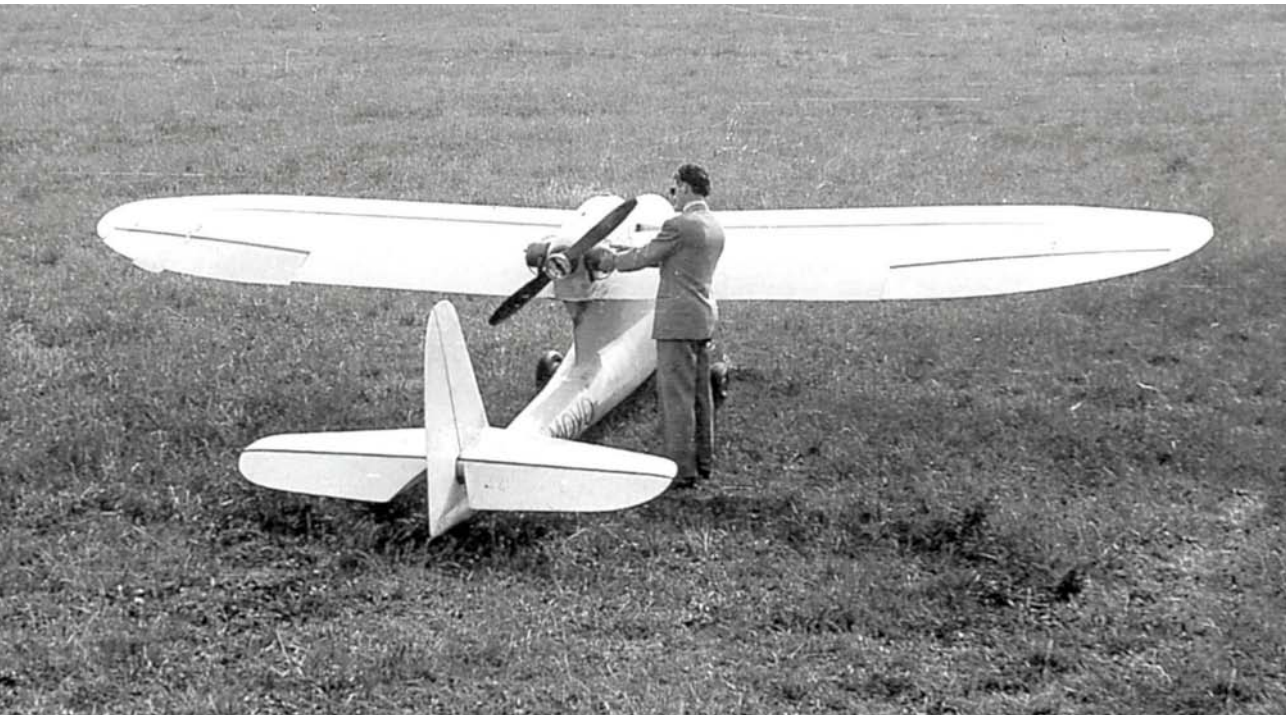
BELOW ***The sole Movo FM.1 at Milan-Linate airfield. The well-dressed man adjusting the engine provides scale for the diminutive Passero and highlights the type's short wingspan, ill-suited to a motor-glider.***

ITALIAN AIRCRAFT designer Stelio Frati (1919–2010), famous for the F.8 Falco sport aircraft and shapely SF.260 trainer, grew up in Milan and started building models at the age of 15. This put him in touch with Gustavo Clerici (1909–64), who in 1932 had established the Modelli Volanti (flying models — shortened to Movo) shop. Frati went on to study aeronautical engineering at the prestigious Milan Polytechnic under Prof Silvio Bassi. He also joined its Centro di Volo a Vela (Gliding Centre — CVV), founded in 1934 to give students first-hand experience of design, construction and flying. On completing his doctorate on December 21, 1943, Frati became an assistant to Bassi and began working with Aeronautica Lombarda, part of the Ambrosini group.

In 1946 Frati published a comprehensive sailplane design manual, *L'aliante*, that showed his mastery of light aircraft construction. The same year Frati also conceived the BF.46 sailplane and the F.1 motor-glider, intended to answer a perceived need for inexpensive private aircraft. Clerici, who had served as a transport pilot during the Second World War, agreed to support the latter project, which became the Movo F.M.1 Passero ("Sparrow").

The F.M.1's all-wood design borrowed elements from various CVV gliders, with the cockpit resembling the CVV.5 Papero and including the latter's nose skid. The single-spar single-piece wing had a ply-covered D-box leading edge for torsional stiffness, but was otherwise fabric-covered, as were the cable-operated control surfaces.

GIORGIO APOSTOLO



GIORGIO APOSTOLO

ABOVE ***The as-yet unflown F.M.1 on display at the Milan Fair in April 1947, during which several new types made their debuts following the lifting of the Allied ban on private flying in Italy. The Passero went on to make its maiden flight on November 2 the same year.*** **INSET BELOW** ***Modelli Volanti (Movo) founder Gustavo Clerici was a qualified pilot and had served as a captain flying transport aircraft in the Regia Aeronautica during the Second World War.***

ALESSANDRO CLERICI

The rubber-sprung fixed undercarriage comprised low-pressure 260mm x 100mm mainwheels and a steel tailskid. The 20 h.p. Macchi MB.2 two-cylinder engine was mounted in a pusher configuration, and was fed by a single 25lit (5½gal) tank. Unusually, the engine controls consisted of a motorcycle-style twist throttle. Instruments were limited to airspeed, altimeter, rate of climb, engine r.p.m. and temperature.

A SPARROW AT THE FAIR

With private flying still banned by the Allied Armistice Commission, construction was undertaken semi-clandestinely in the Movo courtyard in Via di Santo Spirito in central Milan. Clerici and Frati both worked on the Passero, although some years later Frati recognised Guido Unfer as the main builder. By February 1947 the basic structure was complete and the Passero was unveiled that April at the Milan Fair, together with the Alaparma AM.9, Macchi MB.308, SAI Ambrosini 1001 and the pre-war Avia FL.3.

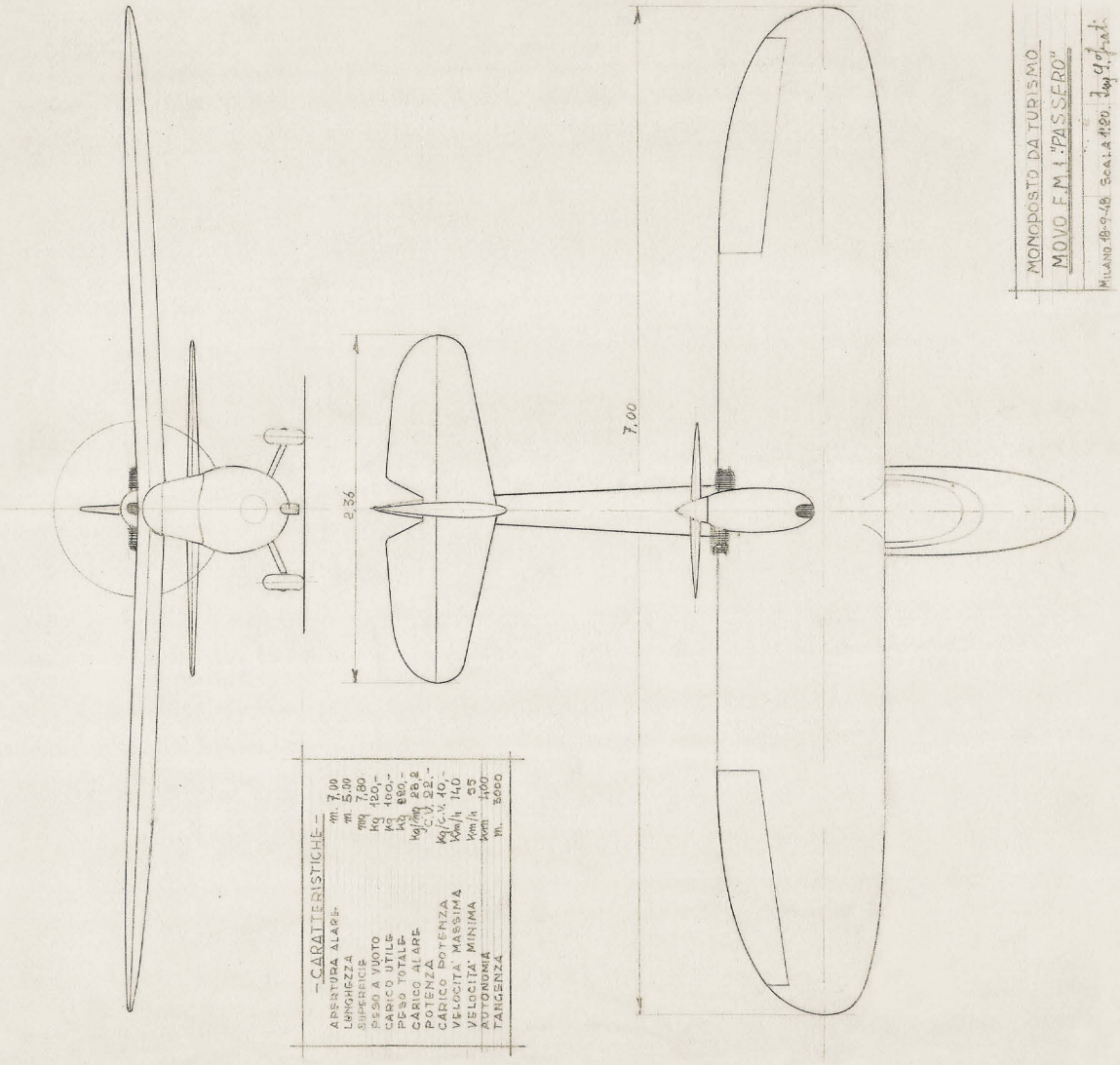
At the time, Movo envisioned selling the single-seat Passero at 1·2 million *lire* and the two-seat F.M.2 at 1·7m lire, less than the Avia FL.3 (2m lire) and Macchi's MB.308 (2·1m lire). Deliveries were planned from the spring of 1948 and Movo applied to the *Registro Aeronautico Italiano* (RAI) to monitor construction with a view to certification.

After the Milan Fair the F.M.1 underwent static testing in the CVV workshops, and in October 1947 it was taken to Venegono Superiore airfield, near Varese, for test flying by Edgardo Vaghi, another Polytechnic engineer and CVV member. Aged 21, Vaghi had placed 11th in the two-seat bobsled in the 1936 Winter Olympics in Garmisch. He later became a fighter pilot, flying Macchi MC.200s in Russia (where he earned a Silver Medal for Gallantry) and Reggiane Re.2005s in Sicily (where he claimed a Spitfire on July 11, 1943).

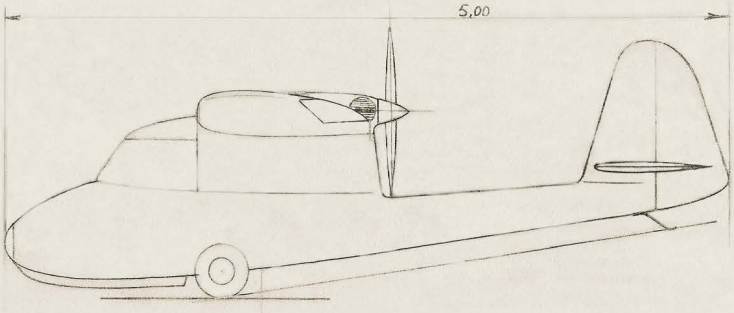
THE SPARROW TAKES WING

On November 2, 1947, Vaghi made two taxy runs and lifted off. Flying was apparently confined to the aerodrome area, just large enough to assess its general handling as pleasantly responsive and undertake some measured speed runs. On a 1km (3,280ft) base, the diminutive aircraft reached almost 150km/h (93 m.p.h.).

Like fellow Italian designer Ermenegildo Preti's PR.2 Saltafossi *(as related by the author in*



This original general arrangement drawing of the F.M.1 Passero, signed by Stelio Frati, is dated September 18, 1948, some two years after construction on the aircraft had started. Frati always built from a limited number of drawings, solving problems as they arose. When Carlo Murelli decided to build a second F.M.1, he had very few drawings to work from.



VIA CARLO MURELLI

AUTHOR'S COLLECTION

ABOVE ***The F.M.1 made its first flight from Venegono, the Macchi company airfield near Varese. Its 20 h.p. MB.2 engine was created by Macchi chief designer Ermanno Bazzocchi, also a Polytechnic graduate, and derived from that of his Macchitre three-wheeled van. The Passero was later fitted with a more powerful Continental A65 engine.***

A 350lb Mystery *in* TAH5 — *Ed)*, the F.M.1 was woefully underpowered. Its small wing, hardly suitable for a motor-glider, betrayed Frati's love of speed. The short undercarriage made rotation difficult, resulting in unnecessarily long take-offs. Adriano Mantelli, who flew the F.M.1 before relocating to Argentina in 1947, nevertheless found it pleasant; Nello Valzania flew it too.

In September 1948 Vaghi displayed the F.M.1 at Linate for the Giornata Aerea della Madonnina show. At the suggestion of Iginio Guagnellini, the aircraft was entered in the show's planned air race, for which it was fitted with an American horizontally-opposed four-cylinder air-cooled Continental A65 engine. Unfortunately the race was cancelled.

Movo next considered offering both "light" and "sport" variants of the F.M.1, with two- and four-cylinder engines respectively. Only the first option was pursued, replacing the Macchi MB.2 engine with the Preti-designed 22 h.p. pull-start P.25 engine. The sole F.M.1 never received a Certificate of Airworthiness, however, and was retired with some 30hr total flying time. It was put into storage in the mid-1950s, and all trace of it was lost after the Milan Aero Club moved from Linate to Bresso. Rumours circulate that it was damaged beyond repair in a flood.

A SPARROW FOR TWO

Design of the two-seat F.M.2 Bipassero (Twin Sparrow), which featured side-by-side seating, automobile-style doors and a tricycle undercarriage, was completed in early 1948. The

Most photographs show the F.M.1 sporting the civil registration I-MOVO, reflecting the model company's role in its construction. The registration was reserved when construction of the Passero was started, but the aircraft never received a Certificate of Airworthiness, so it was not taken up. Note the sole trim tab fitted to the port aileron only.

GIORGIO APOSTOLO

CARLO MURELLI

ABOVE ***A Sparrow reborn — Carlo Murelli's Passero was built from scant information over a 12-year period and first flew in August 2006. It is seen here fitted with a 40 h.p. Simonini engine, spatted wheels and a two-piece wing. Many of the parts required to complete the new Passero had to be reverse-engineered from other CVV types.***

aeroplane was intended to accommodate two coupled P.25 engines, each weighing 30kg and delivering 45 h.p. Press reports suggest that Frati attempted to switch production from Movo to SAI Ambrosini. By January 1948 two parallel designs were described; the Movo F.M.2 and SAI F.M.2. Both remained unbuilt.

In 1949 Frati established his reputation by creating the Ambrosini F.4 Rondone, with which Guagnellini dominated the Italian racing scene for a decade. Movo continued to serve modellers, branching into ships and automobiles. It is still active, under different ownership, in Pioltello.

In 1994 Carlo Murelli, another Milan Polytechnic graduate, decided to build a Passero. Starting from the few surviving drawings, and encouraged by Frati and Mantelli, Murelli redesigned the F.M.1, adopting a two-piece wing to fit the workshop. The new Passero taxied in 2004 with a 25 h.p. engine, and eventually flew on August 6, 2006, with a 40 h.p. Simonini Victor 1. Placed on the Italian ultralight register as I-9687, it handles superbly, according to Murelli, who flies it from an airstrip near Lodi. The aircraft required only minor changes to improve its stall characteristics. A reminder of Frati's first humble fledgling is alive and well.

ACKNOWLEDGMENTS *The author would like to thank Giorgio Apostolo. Alessandro Clerici, Roberto Mantelli, Enzo Marrucci, Carlo Murelli and Giulio Valdonio for their invaluable help with the preparation of this feature*

MOVO F.M.1 PASSERO & F.M.2 BIPASSERO DATA

Powerplant
F.M.1 1 x 20 h.p. Macchi MB.2 two-cylinder horizontally-opposed air-cooled engine
F.M.2 2 x 45 h.p. Ambrosini P.25 four-cylinder horizontally-opposed air-cooled engine

	F.M.1	F.M.2
Dimensions		
Span	7·0m (22ft 11in)	9·0m (29ft 6in)
Length	5·0m (16ft 5in)	6·0m (19ft 8in)
Height	1·4m (4ft 7in)	—
Wing area	7·8m² (84ft²)	12·5m² (135ft²)
Aspect ratio	6·4:1	6·48:1
Weights		
Empty	140kg (309lb)	210kg (463lb)
Maximum	240kg (529lb)	410kg (904lb)
Performance		
Speed		
Maximum	152km/h* (94 m.p.h.)	165km/h** (103 m.p.h.)
Cruise	130km/h (80 m.p.h.)	140km/h (87 m.p.h.)
Stall	55km/h (34 m.p.h.)	55km/h (34 m.p.h.)
Ceiling	3,500m (11,500ft)	4,000m (13,100ft)
Range	550km (340 miles)	500km (310 miles)

*Actual ** Design estimate

KILL 'EM, CHILL 'EM & FLY 'EM OUT!

AUSTRALIA'S AIR BEEF OPERATIONS 1946-62

The proprietors of Fossil Downs cattle station in Western Australia show off a pair of prize bulls beside Douglas DC-3 VH-MML of MacRobertson-Miller Airlines in October 1957. Built as C-47B serial number 44-76613 before serving with the RAF as KN470 during World War Two, the aircraft was one of three used by the airline on the joint Air Beef venture with Australian National Airways during 1946–62.

AIRWAYS MUSEUM / CIVIL AVIATION HISTORICAL SOCIETY

AIR BEEF ARTWORK BY JUANITA FRANZI

With few roads and no rail system, Western Australia presented scant reward for its livestock farmers, who faced arduous month-long cattle-drives across the remote outback to reach the nearest slaughterhouse — until two aviation-inspired visionaries collaborated to revolutionise the region's beef industry using DC-3s and Bristol Freighters, as **NICK STROUD** explains

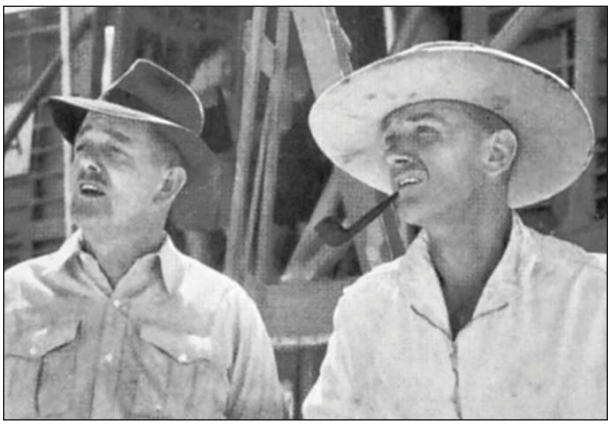
WITH ITS VAST expanses of featureless territory spreading over a continent covering nearly 2,500 miles (4,000km) from Steep Point on its far western coast to Byron Bay at its easternmost point, Australia has always been a nation open to the unique time- and labour-saving possibilities of air transport. Indeed, much of the transformation of that immense and largely inhospitable continent into a successful modern post-industrial nation has been dependent on the introduction of the aeroplane.

A shining example of air transport working in perfect harmony with one of the country's more traditional vocations was the establishment of Air Beef Pty Ltd, a joint operation created by Australian National Airways (ANA), MacRobertson-Miller Aviation (MMA) and a group of visionary pastoralists working in the successful — but extremely remote — beef cattle stations of the Kimberley, one of the nine regions of Western Australia (WA), in the immediate post-war period.

The Air Beef scheme was largely the brainchild of two visionaries: Gordon Blythe, a highly experienced livestock farmer who saw greatly increased efficiency — and profits — in the shape of the aeroplane; and ANA's Planning & Development Manager, Ian H. "Grab" Grabowsky, a former pilot who had seen the advantages of air transport while supplying isolated communities in New Guinea before the Second World War. Both provided expertise in their respective fields to create one of the most outstanding achievements in post-war Australian aviation, with the help of a modest fleet of Douglas DC-3s and Bristol Freighters.

NEW GUINEA EXPERIENCE

In the mid-1930s Ian Grabowsky worked for Guinea Airways, which earned its reputation as the world's premier air transport specialist operating various aircraft from Lae in New Guinea to the goldfields at Bulolo in the highlands.



VIA FRED NIVEN x 2

ABOVE LEFT ***The two chief architects of the Air Beef concept — Ian Grabowsky (left) and Gordon Blythe — oversee work at Glenroy Station, the central hub of the innovative scheme.*** **ABOVE RIGHT** ***Gordon (left) and Keith Blythe, fourth-generation Kimberley pastoralists, saw the potential in the use of aircraft for livestock farming.***

New Guinea at that time represented something of a laboratory for air transport, and by the middle of the decade Guinea Airways had become the world's largest air-freight operation, carrying more cargo by air than the rest of the world's airlines combined.

As a pilot and later manager for Guinea Airways, Grab saw enormous quantities of food being flown into the highlands, one aircraft being dedicated just to bringing meat in across the mountains; why not adopt the same system for the vast expanses of his native Australia?

During 1937–38 Grabowsky submitted a scheme to the Commonwealth Government, in which he outlined a proposal to open up the outback with an ambitious system of airfields. His experience in New Guinea had proved that, although some communities still regarded aviation as a horse-frightening novelty, the aeroplane could carry any type of load, from gold to fresh eggs, over any type of territory in most types of weather, provided a decent airstrip could be carved out of the local soil. Indeed, the Junkers-G 31s of Guinea Airways had flown eight 3,000-ton gold dredges into Bulolo from Lae, every piece of each dredge having been designed to be air-transportable. Guinea Airways had proved that the possibilities of air cargo operations were enormous.

Grabowsky was determined to show that Australia could be extensively developed with the use of air transport, obviating the need for huge capital outlay on expensive road or rail networks. The 1930s Lyons government was sceptical, however, seeing road and rail as a far cheaper alternative to building brand new airports. Grab pointed out that road and rail transport could only be considered cheaper if the cost of the actual construction of railway lines and roads was not factored in; when it was, it was clearly more economical to build a relatively short airstrip at each town than a long road which had to wind through varying forms of topography to connect each settlement.

In the late 1930s the state-owned railways were losing millions of pounds a year; Grab was convinced that aviation was the solution to the expensive infrastructure problem. However, with the outbreak of war in Europe in 1939 the Australian Government turned to more pressing matters and Grabowsky's ambitious ideas were set aside for the duration of World War Two.

THE PROBLEM – AND A SOLUTION

Covering 125,000 square miles (323,750km²), the Kimberley lies 250 miles (400km) south, east and west of the 19th Century goldrush settlement of Wyndham, the northernmost town in WA. By the 1940s the Kimberley had been "settled" cattle country for several generations, livestock being the region's staple industry. A perennial problem with operating in such a remote area, however, was that cattle ready for killing — or "fats" — had to be taken long distances overland — sometimes hundreds of miles — to killing stations or ports with suitable facilities.

To stand a chance of surviving these long treks, which were extremely rigorous even in the best conditions, the fats had to be five to six years old. However, the British beef market, for which most of these cattle were ultimately destined, demanded two- to three-year-old beef. The livestock farmers were forced to range their cattle until they were at least five years old, then drove them over long distances to be killed, losing many cattle along the way and, significantly, reducing the quality of the fats.

One of the nearest cattle stations to Wyndham, Ivanhoe, was only 50 miles (80km) away, but five-year-old beasts driven into Wyndham could lose up to 35–50lb (15–22kg) in weight. For cattle from Argyle Downs and Newry, some 120 miles (195km) from Wyndham, the loss figure was nearer 60–70lb (27–30kg). With the

AIRWAYS MUSEUM / CIVIL AVIATION HISTORICAL SOCIETY

ABOVE ***The remote settlement of Wyndham, the oldest and northernmost town in the Kimberley region of Western Australia, in 1951. The featureless area to the upper left of the image is not water but inhospitable mudflats. The meatworks, established in 1919, represented Wyndham's main source of employment until its closure in the 1980s.***

advent of the aeroplane, a solution lay at hand.

Given that there were no navigable rivers that could be used to transport the cattle, the only available options were rail, road and air. Grabowsky argued that by constructing a network of airfields not more than 40 miles (65km) apart, or using existing runways and adding new ones in between points on the cattle-droving route, even Australia's most remote areas could be supplied and serviced.

It was estimated that a first-class airfield would cost £40,000 to build, the total cost for 72 proposed airfields in WA coming to £2,880,000. To provide coverage of a similar area by rail would require some 3,600 miles (5,800km) of track, at a cost of at least £50 million. If the road option was taken, 3,840 miles (6,180km) of surface paving would have to be laid at a cost of about £20 million, based on contemporary costs. These figures did not include maintenance and other fixed costs, which would probably account for another £3 million (rail) or £1·5 million (road). To handle the region's cattle output for each season would require five locomotives and 130 cattle trucks (at a cost of £100,000) or nine 40-ton road semi-trailers (£70,000). The annual cost of operating an air system, allowing for airport maintenance and aircraft-operating costs, was estimated at approximately £420,000, as against the equivalent annual cost of doing it all by rail at £1m or by road at £500,000. The final estimates showed that, calculated for the transport of 20,000 tons of beef, the cost by air was approximately 2¼d per lb, 2¾d per lb by road and 6d per lb by rail.

Working it another way, Grabowsky estimated that the cost per ton-mile worked out at around 2d by rail, 9d by road and 14d by air. Road and rail transport appeared cheaper on this basis, but Grab's argument was based on the fact that the air solution required far less capital outlay and ongoing maintenance costs, thereby giving a much more desirable ton-mileage ratio. Grab was also convinced — correctly, as it transpired — that the airfields he envisaged could be built for a tiny fraction of the estimated £40,000. Crucially, the capital needed for the air solution was considerably less than that needed to build road or rail systems; an important consideration given the prevailing atmosphere of post-war economic austerity.

There were also other considerable benefits to using air transport, not least the time factor; the air system could be tried out with minimal outlay immediately, whereas the rail and road solutions would, by their nature, take some time to be adequately developed and completed.

THE VISIONARY PASTORALIST

One of the key men on the Kimberley cattle stations was Gordon Blythe, one of three brothers who owned a number of stations in the Kimberley, including two of the biggest, Mount House and Glenroy, which covered a staggering 1·25m acres and were capable of pasturing some 20,000 cattle. As a sergeant in the Second Australian Imperial Force during World War Two, Blythe had been stationed on the Pacific island of Bougainville, and while there he had been impressed by the use of aircraft for the transport of supplies.

Blythe was unaware of Grabowsky's similar ideas, which were originally intended for use in Far Northern Queensland, but in May 1946 he approached north-west Australia's pioneering air transport company, MacRobertson-Miller Aviation Co Ltd (MMA Co Pty Ltd from July 1950), to ask if it would lend an aircraft and crew for an experimental flight carrying a load of beef from Mount House to Derby on the WA coast. The company agreed to provide a Lockheed 10A Electra free of charge, but the chilling plant at Derby was damaged in a fire the week before the planned flight and it was called off.

AIRWAYS MUSEUM / CIVIL AVIATION HISTORICAL SOCIETY

LEFT ***Beef is unloaded at Perth from Lockheed 10A Electra VH-ABV in July 1946, contrary to some reports which claim that the aircraft was VH-ABW and the date the following year. Official reports erroneously state that the aircraft used on the first beef run to Perth was "VH-MMD (then called VH-ABW)"; 'MMD was in fact VH-ABV before being re-registered in October 1948, and 'ABV was based in Derby at the time, making it a more likely candidate.***

Undeterred, Blythe tried again that July, accompanying four unchilled beef carcasses on the 2,000-mile (3,200km) flight — with one refuelling stop — from Mount House to Perth aboard MMA Electra VH-ABV. After a 10hr flight the beef arrived in perfect condition and was donated to the Red Cross, raising £50 at auction. Grabowsky had done the theoretical work on the "beef by air" concept and Blythe had proved that it was practical — it was time to turn Air Beef into a reality.

On November 4, 1948, Air Beef Pty Ltd was founded as a consortium of ANA, MMA and a group of WA pastoralists led by Gordon Blythe, with the aim of transporting beef produced by the remote West Kimberley cattle stations from Glenroy to Wyndham during the annual "killing season", which usually ran from May to late August/early September. The company was formed with an initial capital of £15,000 (split equally between ANA, MMA and the pastoralists) plus a three-year interest-free loan of £10,000 per annum from the WA government, which also agreed to a subsidy of 1d per lb of meat transported by air in the region during the first year.

Shortly after the establishment of the company, it was decided that an abattoir should be built at Glenroy to slaughter and chill the cattle, after which the carcasses would be flown on to Wyndham, where they would be frozen and packed at the Government abattoir, mainly for shipment to the UK.

Construction of the Glenroy abattoir began on January 2, 1949, an MMA DC-3 flown by Capt Cyril Kleinig flying in the first shipment of building materials three days later. The abattoir was completed in the second week of May 1949 at a cost of £30,000, which included the men's quarters and community buildings. Glenroy had been chosen as the central hub of the cattle operation as it had an elevated natural all-weather landing ground with gravel subsoil for good drainage only five miles (8km) from the Glenroy station homestead.

Far from costing the originally estimated £40,000 for a serviceable airfield, the landing ground at Glenroy was improved to Department of Civil Aviation standards for £100, although there were initial problems with the supply of water with which to mix concrete for the station's buildings. This was solved, however, when drilling by Derby station owner Sam Thomas revealed a source of water some 145ft (45m) below the surface. With the abattoir at Glenroy complete and the infrastructure for Air Beef operations in place, the company was ready to start its first official season.

THE SCHEME BEGINS

On May 13, 1949, Air Beef operations officially began with MMA DC-3 VH-MMF operating between Glenroy and Wyndham, the company having stationed three pilots — Capts Cyril Kleinig, Sturdee Jordan and Bill Pepper — at Glenroy for the season; ANA supplied Capt John Bunstead as copilot and photographer.

Initially three round-trips over the 185 miles (300km) between Glenroy and Wyndham were operated daily using a pair of MMA DC-3s— VH-MMF and VH-MML — plus one ANA DC-3, all of which were non-refrigerated. The Air Beef system accepted cattle from various stations in the region (including Bedford Downs, Fossil Downs, Gibb River, Mount Hart, Mount House, Karunjie, Lansdowne, Spring Vale and Tableland among others), which were slaughtered at the abattoir at Glenroy, where the meat was graded according to its quality and chilled for 22hr before being flown up to Wyndham. The livestock farmers would be paid according to weight and grade on the entire carcass.

During the first season, most of the cattle sent to Glenroy were six-year-olds, payment

MAP BY MAGGIE NELSON

averaging around £9 per carcass. The local cattle stations soon began sending three- to four-year-old cattle to Glenroy, which was economically advantageous to the station owners as they did not have to range cattle for the extra few years to make them sufficiently sturdy to make the journey all the way to Wyndham. Essentially, the station owners could turn over their stock twice as fast as under the old droving conditions.

Flying the carcasses to Wyndham for onward processing was all very well, but what of the economic problem of flying empty back to Glenroy at 2d per mile? The issue of "backloading" was solved by air-freighting supplies for the cattle stations back to Glenroy, including food, machinery, salt for hides, fencing wire, corrugated iron and sundry other vital equipment which had previously called for a truck to battle across the roadless Kimberley outback for days.

By the end of the 1949 season the DC-3s had transported some 1,776 carcasses from Glenroy to Wyndham, with Air Beef Ltd just about covering its expenses. It was a significant improvement on the previous season, which had seen only 494 head of cattle reach Wyndham by land from Glenroy. Inevitable teething troubles

AIR BEEF IS THE ANSWER!

THE TABLE BELOW was published in an article on Air Beef Pty Ltd in the September 1951 issue of Australian National Airways' *Staff News* bulletin.

The following mileage figures illustrate that Air Beef provides one of the major answers towards developing the vast outback areas of Australia.

By stock route		
Glenroy to Wyndham	*300 miles*	*(482km)*
Glenroy to Derby	*250 miles*	*(400km)*
Glenroy to Broome	*425 miles*	*(685km)*
By road		
Glenroy to Wyndham	*800 miles*	*(1,285km)*
Glenroy to Derby	*298 miles*	*(480km)*
By air		
Glenroy to Wyndham	*185 miles*	*(300km)*
Glenroy to Derby	*165 miles*	*(265km)*
To drove cattle from		
Glenroy to Wyndham	*30 days*	
Glenroy to Derby	*21 days*	
Glenroy to Broome	*43 days*	
By ANA Bristol Freighter		
Glenroy to Wyndham	*1hr 15min (approx.)*	
Glenroy to Derby	*1hr 6min (approx.)*	

AIRWAYS MUSEUM / CIVIL AVIATION HISTORICAL SOCIETY

ABOVE ***DC-3 VH-MML at Wyndham on an early Air Beef run. The aircraft had an adventurous career; after its RAF wartime service it was returned to the USAAF in 1947, going on to serve with the Pakistan Air Force as H-717 during 1947–54. It was sold to Field Air Services at Karachi and registered G-ANMA, MMA acquiring it in April 1954.***

with maintenance and other factors limited the success of the venture in its first season, but lessons were learned and the pastoralists were delighted to discover that the air-freighted carcasses had produced more than 16 per cent more beef than those killed at Wyndham as per the old system.

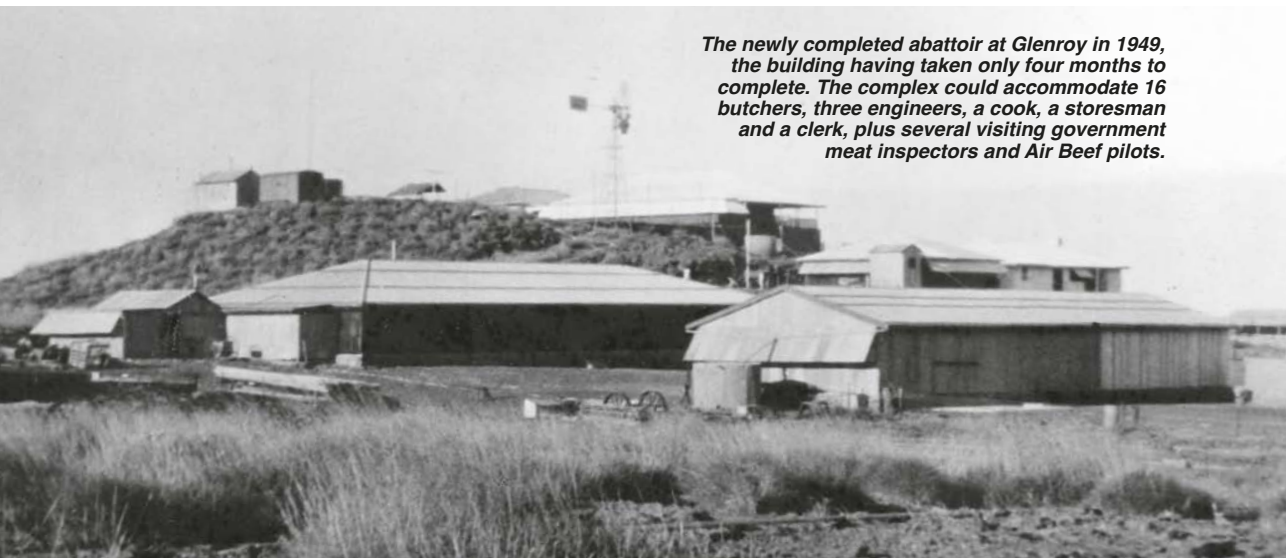
THE BRISTOL FRIGHTENER

Although the 1949 season had seen a number of minor setbacks, the Air Beef concept had shown a great deal of promise and the company was confident that using larger aircraft would yield greater profits, as well as offer the ability to backload substantially larger freight items. In addition, a severe drought during the 1950 season caused far more cattle to be sent for slaughtering, requiring more carcasses to be transported to Wyndham per flight.

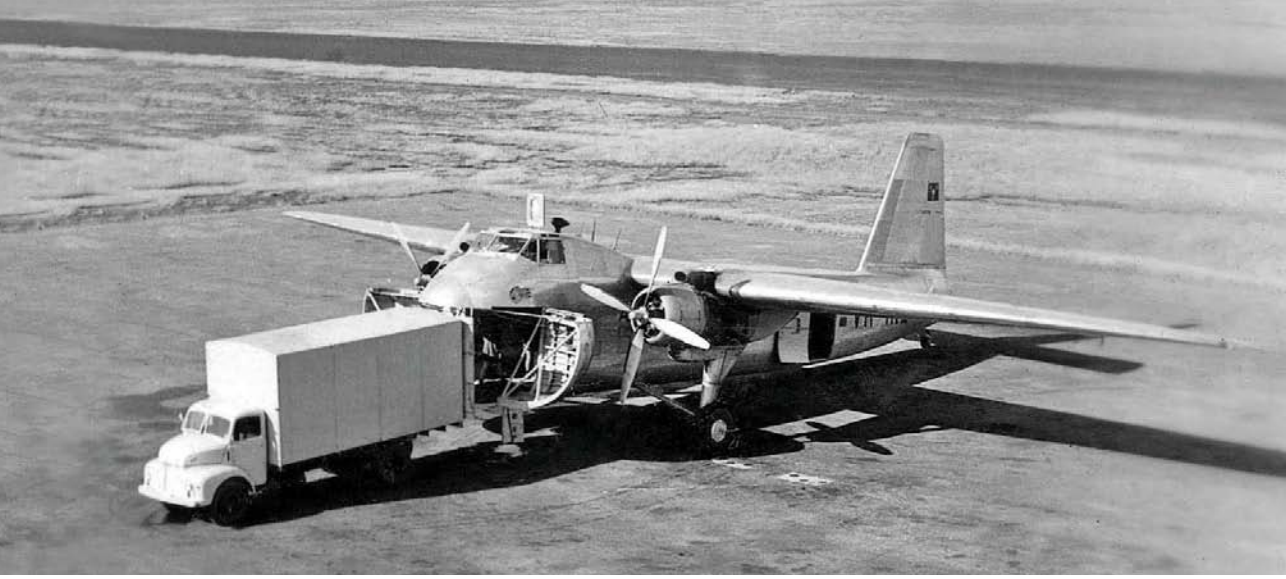
Australian National Airways received its first Bristol 170 Freighter, G-AICL, in late 1948 and immediately put the somewhat staid — but very effective — aircraft to good use transporting wool from Tasmania to Melbourne. The Freighter proved so efficient that the chartered G-AICL was retained by ANA and given the Australian civil registration VH-INJ. Two more Mk 21 Freighters (originally G-AHJC and G-AICR) were acquired by ANA and re-registered as VH-INK and VH-INL respectively.

The type was a natural choice for the Air Beef scheme and VH-INL, named *Mannana*, was used on the Glenroy—Wyndham run throughout the 1950 season, carrying up to 12,000lb (5,445kg) of carcass meat on each of three trips a day. By September that year *Mannana* had carried more than 2,000,000lb (905,000kg) of beef and flown some 82,400 miles (133,000km) over 588hr. From the 1,776 head of cattle carried during the 1949 season, the next season's figure had more than doubled to 3,676. The Bristol Freighter — or "Frightener" as it was affectionately dubbed by

TAH ARCHIVE



The newly completed abattoir at Glenroy in 1949, the building having taken only four months to complete. The complex could accommodate 16 butchers, three engineers, a cook, a storesman and a clerk, plus several visiting government meat inspectors and Air Beef pilots.



AIRWAYS MUSEUM / CIVIL AVIATION HISTORICAL SOCIETY

ABOVE ***Australian National Airways (ANA) Bristol Freighter VH-INL at Wyndham during the 1952 Air Beef season. Ian Grabowsky's original plan was to start cattle-freighting operations in Queensland, with ANA as the senior partner; MMA would be senior partner for WA operations, but in the event the Queensland operation never started.***

its crews — had expanded on the promise of the first season and the type would see further service during the 1951 Air Beef season.

For the third season — May to late September 1951 — a second Bristol Freighter, VH-INJ, was added to the Air Beef scheme, the slow but steady twins ferrying more than 3,000,000lb (1,360,000kg) of beef and hides between Glenroy and Wyndham, entailing a total aircraft mileage of 82,235 miles (132,345km). During one record-setting day 46,200lb (20,955kg) of beef was carried, each flight fully backloaded on the return to Glenroy.

The Air Beef scheme was an unqualified success and more graziers were signing up, having recognised the substantial economic advantages of exporting their beef by air. The successful conclusion of the third season, however, gave the Commonwealth Government pause for thought; the next logical step after proof of concept — further development of the scheme — would realistically be too big a matter for private enterprise to handle. Assistance was sought in the form of a direct subsidy from the Government or a grant for the construction of killing centres in other cattle-rearing areas.

Concurrent with the early Air Beef operations was the establishment of the Commonwealth Government's State Grants (Encouragement of Beef Production) Act, which rubber-stamped funding for the construction of a road network to support the beef industry. It would be some time before the roads would be ready, but it was a plan which would play a major part in the eventual demise of the Air Beef scheme.

Freighters VH-INJ and VH-INL were again used for the 1952 season, which was blighted by another severe drought. Although the Wyndham meatworks' own "kill" was reduced by 40 per cent, the Air Beef abattoir at Glenroy was barely able to handle demand and processed a bumper 5,186 head of cattle to be sent to Wyndham. Indeed, had Air Beef not supplied Wyndham with carcasses, it was estimated that fewer than 1,000 head of cattle would have gone to market from the region.

FLYING THE AIR BEEF ROUTE

In a contemporary report for UK magazine *Flight*, journalist John W.R. Taylor spoke to one of the Air Beef pilots and managed "after a pint or two or three", to persuade him to describe his experience of the Air Beef meat runs. The pilot, who is not named, begins his report with the usual morning routine at Wyndham:

"I was never very impressed by advice about 'early to bed; early to rise', so when, at 0400hr, the alarum by Capt Sturdee Jordan's bed started to clang, I usually got out of bed, blundered over, turned the damn thing off, then dashed back to bed. Outside it was always as black as the ace of spades and cold as charity. At about 0415hr, when we could delay no longer, we got up and dressed, before moving to the next bedroom to dig out the engineer, who slipped trousers and a greatcoat over his pyjamas, so he could go back to bed after we had taken off."

The crew would then be transported in a 15-cwt truck to the airfield at Wyndham, where they "exchanged grunts" with the radio operator — "another pyjamas-and-greatcoat type" — before heading out for the awaiting Bristol Freighter. A visual inspection would then be made, control locks removed, petrol drained from the tanks to check for water and the props pulled through, before the pilots and engineer climbed aboard to start the Freighter's Bristol Hercules sleeve-valve engines.

TAH ARCHIVE

ABOVE ***Quarters of beef are moved along the monorail from the chilling chambers to the open cargo doors of the awaiting Freighter at Glenroy. The 1951 season saw the Freighters making four trips a day — two between Wyndham and Glenroy in the morning and two between Glenroy and Derby in the afternoon — five days a week.***

THE AIR BEEF CREW COMPILED BY FRED NIVEN

THE ALPHABETICAL LIST below comprises those that are known to have been seconded from Australian National Airways (ANA) and MacRoberston-Miller Aviation/Airlines (MMA) for Air Beef Pty Ltd operations in Western Australia during 1949–62, although it is by no means definitive.

Name	Nickname	Airline	Remarks
Adkins, Reginald Charles	"Reg"	MMA	First Officer for four weeks during the 1957 season
Anderson, Donald McColl	"Don"	MMA	Flew at least the 1955 season
Bailey, George J.H.	—	MMA	First Officer for at least the 1956 season
Beer, Kenneth	"Ken"	MMA	Unconfirmed
Brady, Francis A.	—	MMA	Two seasons
Bunstead, John	—	ANA	
Clayton, John	—	ANA	
Cook, Colin James	"Cookie"	MMA	Pilot of de Havilland D.H.90 Dragonfly VH-ADG when written-off on 1.12.47
Griffin, Colin Sidney	"Col"	ANA	
Hames, Raymond Victor	"Ray"	MMA	First Officer (F/O) for the 1956 and 1957 seasons
Holyman, Dare Maxwell	"Max"	ANA	
Jordan, Sidney Sturdee	—	MMA	Several postings, including the 1949 season
Killingworth, Peter	"Dusty"	ANA	1950 season as a ground engineer; 1951 season as F/O and radio operator; also logo-designer/painter
Kleinig, Cyril Nathaniel	—	MMA	At least the 1949 season
King, Peter N.	—	MMA	At least the 1955 season
Ledbetter, Warren	—	ANA	
Linstead, Arthur Richard	"Dick"	MMA	At least the 1956 season
Meadows, George John	—	MMA	At least the 1955 and 1956 seasons
Murray, Jack	—	MMA	Directed Air Beef Pty Ltd May—September 1955
Pepper, William	"Bill"	MMA	At least the 1949 season
Read, Bruce	—	ANA	Radio Operator
Rowell, Harold Mitford	"Harry"	MMA	
Trezise, Percival James	"Percy"	ANA	
Watts, Ross Stephen	—	MMA	At least the 1956 season
Waxman, Joseph Herbert	"Joe"	ANA	July–August 1951
Wensor, Raymond Ernest	"Ray"	ANA	
Whyte, Colin Hugh	"Col"	MMA	

The runway was illuminated with gooseneck kerosene flares and the Freighter was soon hurtling down it and climbing rapidly to get above the surrounding hills. A short call would then be made on the radio to the Wyndham radio operator, giving time of departure, expected time over Karunjie (about halfway to Glenroy) and estimated time of arrival (ETA) at Glenroy. The pilot continued:

"We settled down in silence at the top of the climb. Sturdee and I were good friends and got on well; this pre-breakfast taciturnity was the silence of good friends keeping quiet while their respective livers woke up and gradually got rid of their morning quota of saltiness.

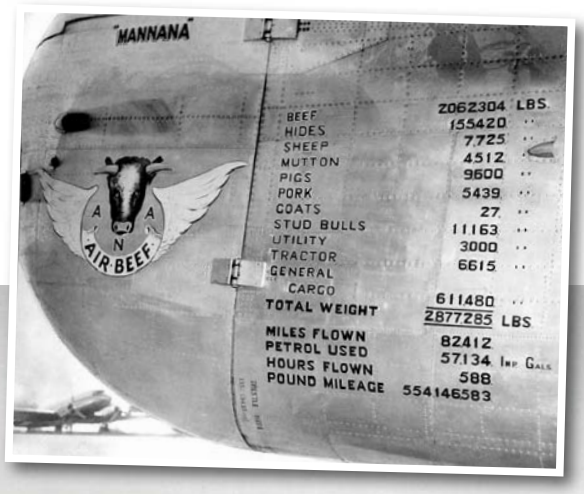
"By this time there would be yet another superb purply-red sunrise, which was watched by us with the same indifference as on umpteen previous mornings. The sunrises and sunsets were so consistently beautiful that after a while they didn't mean a thing except that one indicated a whole day ahead and the other that the end of the working day and a cool drink were not far away."

By the time the Freighter was overhead Karunjie the sun was well up and the crew would be down to shirt, shorts, socks and shoes. At Karunjie the crew signed off Wyndham radio and contacted the operator at Glenroy, signalling time at Karunjie, height, flight conditions and revised ETA at Glenroy. During the Air Beef season the weather was largely predictable, and the 1¼hr flight only ever varied by 5–10min.

Meanwhile, work had started at Glenroy at the same time the Freighter had left Wyndham, so by the time the aircraft landed at the cattle station enough carcasses had been quartered in the chilling chambers to make up a full load for the trip back to Wyndham.

After landing, the Freighter taxied to a marked spot on the strip, where the engines were cut, at which point a gantry carrying a monorail was immediately swung out toward the aircraft so the carcasses could be pushed out of the chilling chambers to within 30ft (9m) of the Freighter. Loading started with immediate effect, the quarters of meat being carried from the end of the monorail by a loader who trotted up an inclined ramp and dumped them on freshly scrubbed canvas on the aircraft's floor. The quarters were then manhandled up the floor of the Freighter and stacked and tied down with plastic-covered ropes. By now it was well past breakfast time, as the pilot explained:

"While all this was happening Sturdee and I dashed over to the mess for a breakfast of damper [Australian soda bread made without yeast and baked in ashes], black tea and beef.



RIGHT ***Complete statistics of Freighter VH-INL's 1950 Air Beef season were painted on the fuselage, as was the aircraft's name,*** **Mannana,** ***above the Air Beef logo.*** **BELOW** ***Carcasses are loaded from the Freighter into a refrigerated truck on the last stage of their journey to the freezing works at Wyndham and on to the UK.***

TAH ARCHIVE x 2

One beast a week was allocated to the mess and it was eaten from nose to tail for breakfast, lunch and dinner, every day of the week. You'd be surprised just how much there is in a plain ornery old bull that doesn't come under the heading of tender steak!"

Breakfast completed, the crew examined the load for security, checked the paperwork and clambered up the rickety ladder through the Freighter's small forward door, started up and were soon off again with 9,000lb (4,080kg) of chilled beef aboard. "By this time we were down to shorts and sandals only — shirts and socks were for cissies, high days and holidays, or for when some VIP came up from the Big Smoke [Perth] to see what wasn't going on and why not".

Back at Wyndham a six-ton insulated truck would be backed up to the aircraft immediately after its arrival and unloading commenced. At the same time, the Freighter was refuelled from an underground tank and, after a cup of tea and a smoke for the crew, the whole operation was started again, this time with a backload for Glenroy. Unlike the pre-dawn calm conditions earlier, the second trip to Glenroy was often subject to much bumpier conditions, requiring a little more attention from the crew. The pilot described the airstrip at Glenroy:

"The run available was about 6,000ft [1,830m] of earth — red, solid, hard as concrete and flat as a billiard table. All you need to make a landing strip in that part of the world is to find a level spot, pull out the bushes and run a grader over the ground to remove small anthills and tussocks, and there she is, as good as any concrete runway, at a total cost of about £100. Not so good when it rains, perhaps, but it just doesn't rain during the Air Beef season — I saw three small cotton-woolly clouds the whole time I was there."

Morale was high throughout the Air Beef operation, with all parties invested in making the scheme a success, as the pilot explained: "Everyone was prepared to turn his hand to anything. Tell a slaughterman in the city that there's no killing today and to go and paint the freezer roof and you'll get a highly descriptive reply. Or tell a city clerk to go and mix some concrete and see what he says.

"There was the usual amount of honest grousing that you get among any bunch of similarly placed men, but there was never a fight or bad dispute all the time I was there."

During 1953 all three of ANA's Freighters were used at various times over the course of the Air Beef season, the aircraft making some 14 trips a week, culminating in 3,524 head of cattle being transported from Glenroy to Wyndham. The 1953 season suffered no mechanical delays, demonstrating the rugged efficiency of the hardworking Freighters.

THE ROAD TO CLOSURE

Despite the clear benefits of the Air Beef scheme, 1954 saw a number of developments that would have long-term consequences for the operation. By the end of 1953 the southern section of the Gibb River Road to Derby had been completed and the first shipment of cattle by truck from the Kimberley was made. The road network was spreading its fingers throughout Western Australia and the idea was mooted that air-freighting may well prove to be somewhat uneconomical in the long term.

A line-up of MMA DC-3s at Perth in 1968, including VH-MMK (middle aircraft), which was used briefly for Air Beef operations. The Air Beef DC-3s underwent a radical weight-reduction programme; auxiliary fuel tanks, de-icing equipment and other items were removed to make them the world's lightest DC-3s, as confirmed by Douglas.

TAH ARCHIVE

ABOVE ***Bristol Freighter VH-INL at Essendon Airport in Melbourne after its return from Glenroy at the end of the 1950 Air Beef Season that September. The two Freighters that operated the Air Beef services — VH-INJ and VH-INL — were eventually withdrawn from use at Essendon during 1959–60, and both had been scrapped by late 1961.***

More importantly, ANA made the decision to pull out of the Air Beef scheme in 1954, relocating its Bristol Freighters to the East Coast. As a result, MMA secured the exclusive contract for Air Beef operations from 1954 onwards, using DC-3s VH-MML, VH-MMF and VH-MMK. From 1955 flights were also made from Glenroy to Derby, 165 miles (265km) to the south-west.

Air Beef continued to thrive for the next five seasons but the continued development of the road network in WA and the construction of a new abattoir in Derby, a deep-water port with more desirable exporting facilities than Wyndham, saw all Air Beef operations switch from the latter to the closer Derby, where Blythe and others had established the Derby Meats Company (Demco).

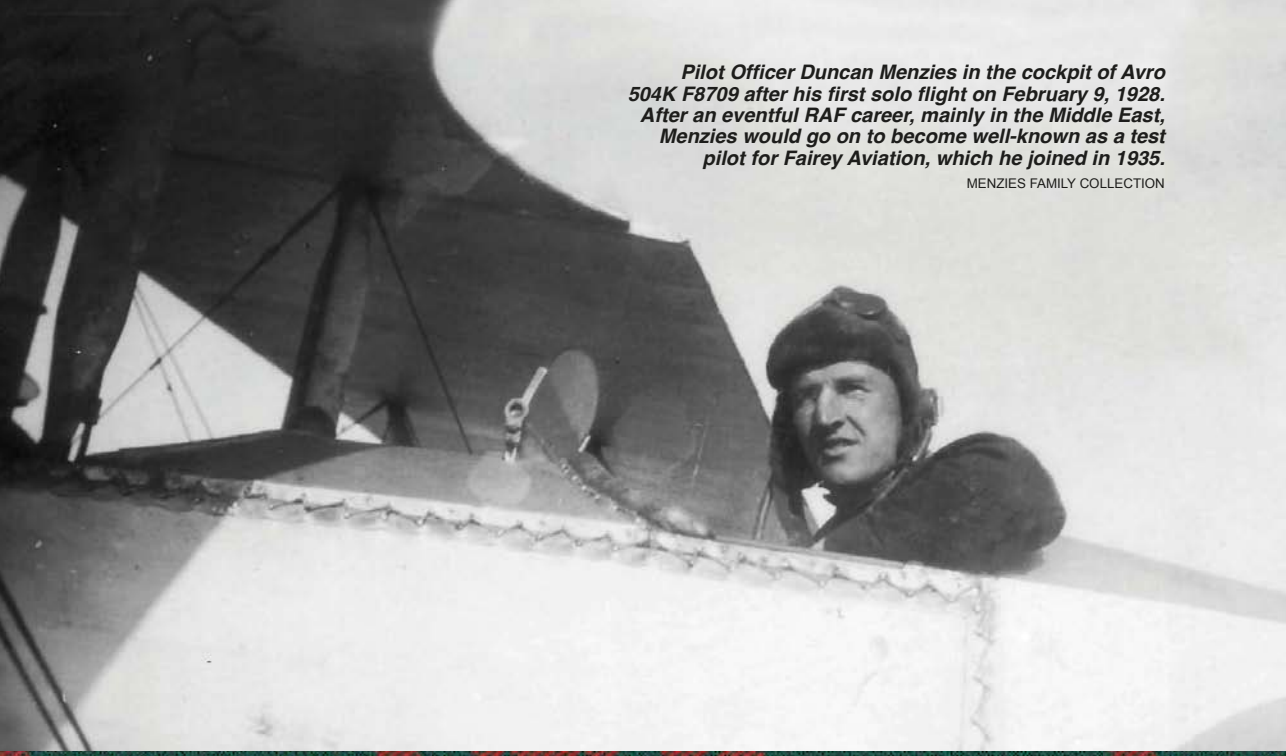
In its issue of April 24, 1959, local newspaper *The Centralian Advocate* stated that "MacRobertson-Miller [Airlines from October 1955] has again been awarded the contract for the Air Beef scheme at Glenroy, which started on April 14. This will be the sixth year in succession that MMA has gained the contract". It added that "the scheme will operate under a different system this year, as all the meat will be flown to Derby instead of Wyndham as in previous seasons. As a result the MMA aircraft will be based at Derby".

By the early 1960s the roads in WA had improved to such an extent that it had indeed become cheaper to transport beef by road, and the 1962 season was Air Beef's last; the beef was transported by road from 1963 onwards.

During 1949–62, Air Beef Pty Ltd aircraft had flown 1,693 return flights between Glenroy and Wyndham and 1,149 return flights from Glenroy to Derby. It had flown a remarkable 14,393 tons of beef and offal and 930 tons of hides over a total of 6,913hr. Some 3,809 tons of cargo was backloaded from Wyndham and Derby to Glenroy and other en-route stations. It had been a remarkable achievement for all concerned. As the Bristol Freighter pilot in John W.R. Taylor's *Flight* report explained:

"At Glenroy everybody wanted to see Air Beef succeed, especially as there were plenty of outsiders who wished the project ill-luck. There were initially shortages of this and that. The diesels gave trouble, the chillers didn't chill; but overall there was a terrific *ésprit de corps* and a bull-headed determination to see the operation succeed and make the doom-and-gloom merchants eat their words. I'm sure that there must be a moral in that somewhere, but I'm hanged if I can find it . . ."

ACKNOWLEDGMENTS *The Editor would like to thank Fred Niven, Merv Prime and Phil Vabre of the Airways Museum/Civil Aviation Historical Society at Essendon Airport (www.airwaysmuseum.com) for their invaluable help with the preparation of this feature*



Pilot Officer Duncan Menzies in the cockpit of Avro 504K F8709 after his first solo flight on February 9, 1928. After an eventful RAF career, mainly in the Middle East, Menzies would go on to become well-known as a test pilot for Fairey Aviation, which he joined in 1935.

MENZIES FAMILY COLLECTION

FROM FARMER TO TEST PILOT

MENZIES CLAN HUNTING TARTAN

The distinguished aviation career of DUNCAN MENZIES / part one

Naval aviation specialist **MATTHEW WILLIS** opens a two-part biography of one of Britain's most distinguished airmen, Duncan Menzies, with the 22-year-old Scotsman's decision to turn his back on a career as a sheep farmer in the Highlands and join the Royal Air Force — at the time regarded as "the greatest private flying club in the world"

IN DECEMBER 1927 at Uxbridge, a 22-year-old Scot was commissioned as a Pilot Officer in the Royal Air Force, marking the start to a remarkable career for the youthful Duncan Menzies, who over the course of the next three decades would become one of the most respected test pilots in the industry. In that time he survived an engine failure in a snowstorm, an aircraft breaking up around him in a high-speed dive and faced the constant dangers of testing new aircraft on a daily basis. From the 1920s to the 1950s this methodical, modest Scotsman was at the forefront of British aviation and did an immense amount to prepare the RAF and Fleet Air Arm for war.

Menzies had not initially planned to become a pilot. Instead, the future career-flyer had expected to become a sheep farmer like his father. The Menzies family, with its roots dating back to the Norman Conquest, was still regarded as a notable part of Scottish society in the 1920s. Duncan's father James owned considerable land, and rented yet more from the Duke of Sutherland, most of which was devoted to the family's flocks. Everything in Duncan's life had led toward him following in his father's footsteps.

After two years of running part of the Menzies estate, during which he clashed with his father over methods of farming, Duncan realised he would not have the freedom to pursue the profession as he wished. He therefore took the bold step of leaving his chosen career and

finding a new one. It did not take him long to settle on the RAF; and from that point, his course was set.

The RAF still had a considerable role in policing the British Empire in the late 1920s, and Menzies learned to fly in Egypt. In January 1928 he sailed in the *SS City of Cairo* from Liverpool to Port Said. From there, he travelled to Abu Sueir, 15 miles (25km) west of Ismailia, to join No 4 Flying Training School (FTS). The unit had a number of Flights, dealing with different areas of RAF flying. "B" Flight, with which Menzies started his training, was for *ab initio* training and was equipped exclusively with Avro 504s.

A souvenir of a distinguished career — Duncan Menzies' distinctive white cloth flying helmet, now kept as part of the family archive.

GAINING WINGS

Menzies made his first flight as an RAF officer as a passenger in an Airco D.H.9A on January 13, 1928. Most of his basic training was conducted, however, on the venerable Avro 504K. After just under 12hr in the air, and less than a month after his flying training began, Menzies went solo in Avro 504K F8709 (which had been erroneously marked as E8709 by the No 4 FTS "erks"). The flight took place on February 9, 1928, and involved take-off, a 10min flight and landing.

On March 16 the same year Menzies suffered the first of a number of failed engines in his career. On his way to a landing ground, the rotary engine of "Avro 4205" (prefix unidentified) failed. Fortunately, Menzies escaped unharmed. Parachutes were sometimes issued to No 4 FTS pilots at this time, but successful bale-outs were rare and accidents often fatal. It was not until 1930 that the unit recorded a successful parachute descent from a stricken aeroplane. Two weeks after the engine failure, Duncan took part in a search for a missing pilot, again showing the risks inherent in desert flying.

That May he transferred to the school's "C" Flight, which provided advanced training for bomber pilots. The flight operated D.H.9As, which were much larger and heavier machines than the Avro, and were affectionately referred to as "Ninaks". These were used for navigation training, among other things, and Menzies took part in a number of cross-country navigation exercises in the second half of 1928. In October 1928, after a little more than 100hr solo flying time, Menzies was rated "above the average" both on the D.H.9A and with regard to his general proficiency as a pilot.

The same month, Menzies joined his first operational unit — No 45 Sqn, operating the Ninak — where he was again rated "above the average". In June 1929 Duncan was posted to No 47 Sqn at Khartoum in Sudan. Menzies' new squadron flew the Fairey IIIF general purpose biplane, which was newer and had far superior performance to the First World War-era D.H.9A.

After Menzies had been at No 47 Sqn for some months, a couple of unusual jobs came up. The first involved the squadron transporting "sacks of poison" during September 6–8 at the request of the governor of Sudan's Kassala Province. The poison was required for the "locust war", a desperate struggle against the crop-stripping insects from which the province suffers to this day.

Three months later Menzies undertook flights "to escort His Excellency the High Commissioner and Air Vice-Marshal to Khartoum".

Menzies (right) and Flt Lt Greenslade stand beside Parnall-built Avro 504K F8709 after the former's first solo flight, at Abu Sueir in February 1928. The "E" in the aircraft's serial is erroneous, E8709 being an Airco D.H.9A.

MENZIES FAMILY COLLECTION

MENZIES FAMILY COLLECTION

ABOVE ***Menzies at the controls of D.H.9A J8189 of No 45 Sqn, based at Helwan, Egypt, during his tenure with the unit from October 1928 to June 1929.*** **BELOW** ***Three Fairey IIIFs of No 47 Sqn at Kassala, Sudan. The "SR" serials signify that the original wooden airframes had been rebuilt with metal parts, more suitable for the tropical climate.***

Menzies was to become familiar with the flight of more than 1,000 miles (1,610km) between the squadron's base in Khartoum and the RAF's regional centre at Aboukir. On February 20, 1930, Menzies set a new speed record for the flight between the two sites, with a total flying time of less than 9hr. The *Northern Times* briefly recorded the feat, which otherwise passed without fanfare:

"A new aviation speed record was set up by Flying Officer Duncan Menzies when he flew from Aboukir in Egypt to Khartoum, the capital of Sudan — a journey of 1,267 miles — in 8hr 50min in a Fairey IIIF biplane. Duncan is the son of Mr James Menzies, Rogart".

The culmination of Menzies' first spell in the Middle East involved the unusual activity, for an RAF squadron, of a big-game hunt led by HRH the Prince of Wales, the future King Edward VIII. The Prince had engaged The Hon Denys Finch Hatton, the famous big-game hunter who was later the subject of the book and film *Out of Africa*, and who at that time was pioneering game reconnaissance from the air. The Prince also engaged No 47 Sqn to assist in the safari.

A ROYAL SAFARI

Menzies' first contact with the royal party was on April 3, 1930, when, according to his logbook, he flew "Mails for HRH Prince of Wales" between Khartoum, Malakal and Juba. The following day, Menzies took Finch Hatton up in Fairey IIIF J9156 to scout for game. Over the next few days, Menzies and Finch Hatton criss-crossed the southern Sudanese landscape between Juba, Mongalla, Torit and Yei, inspecting suitable landing grounds for the

PHILIP JARRETT COLLECTION

LEFT ***Duncan Menzies (in white overalls) beside a Fairey IIIF in Egypt, probably while he was serving with No 47 Sqn. Moving from Helwan to Khartoum in October 1927, the unit used its Fairey IIIFs to co-operate with the Sudan Defence Force in policing the desert regions of the area.***
MENZIES FAMILY COLLECTION

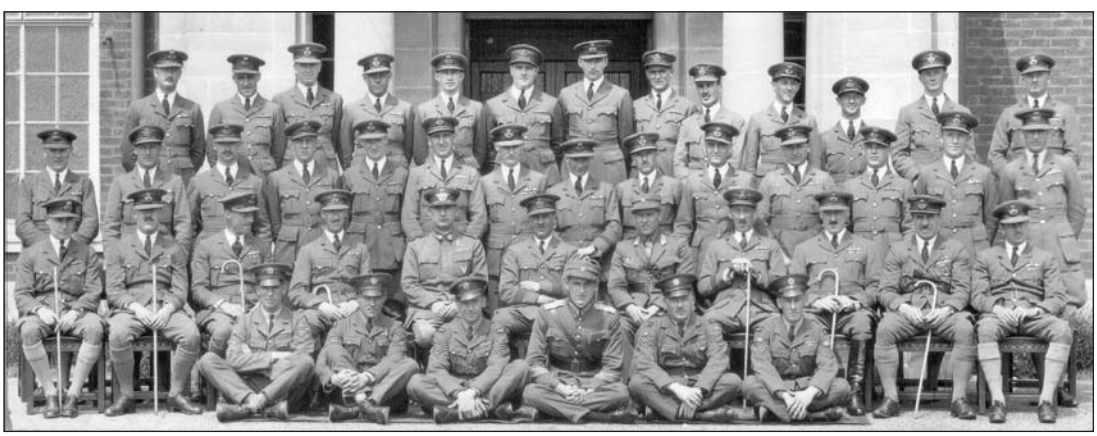
BELOW ***A group portrait taken at the Central Flying School at Wittering in 1930; Menzies is standing sixth from left in the third row. Within three months of his arrival at the CFS, Menzies had been assessed as "exceptional", having proved his flying acumen.***

safari. The following week Menzies flew Finch Hatton to Kosti on the White Nile, before returning to Khartoum. A few days later, on April 16–17, Duncan took Finch Hatton north, out of Sudan and back to Heliopolis in Egypt. On completion of this memorable task, Menzies' tour in the Middle East was over; indeed, his return had been delayed so he could assist the prince's safari, and he took ship for the UK.

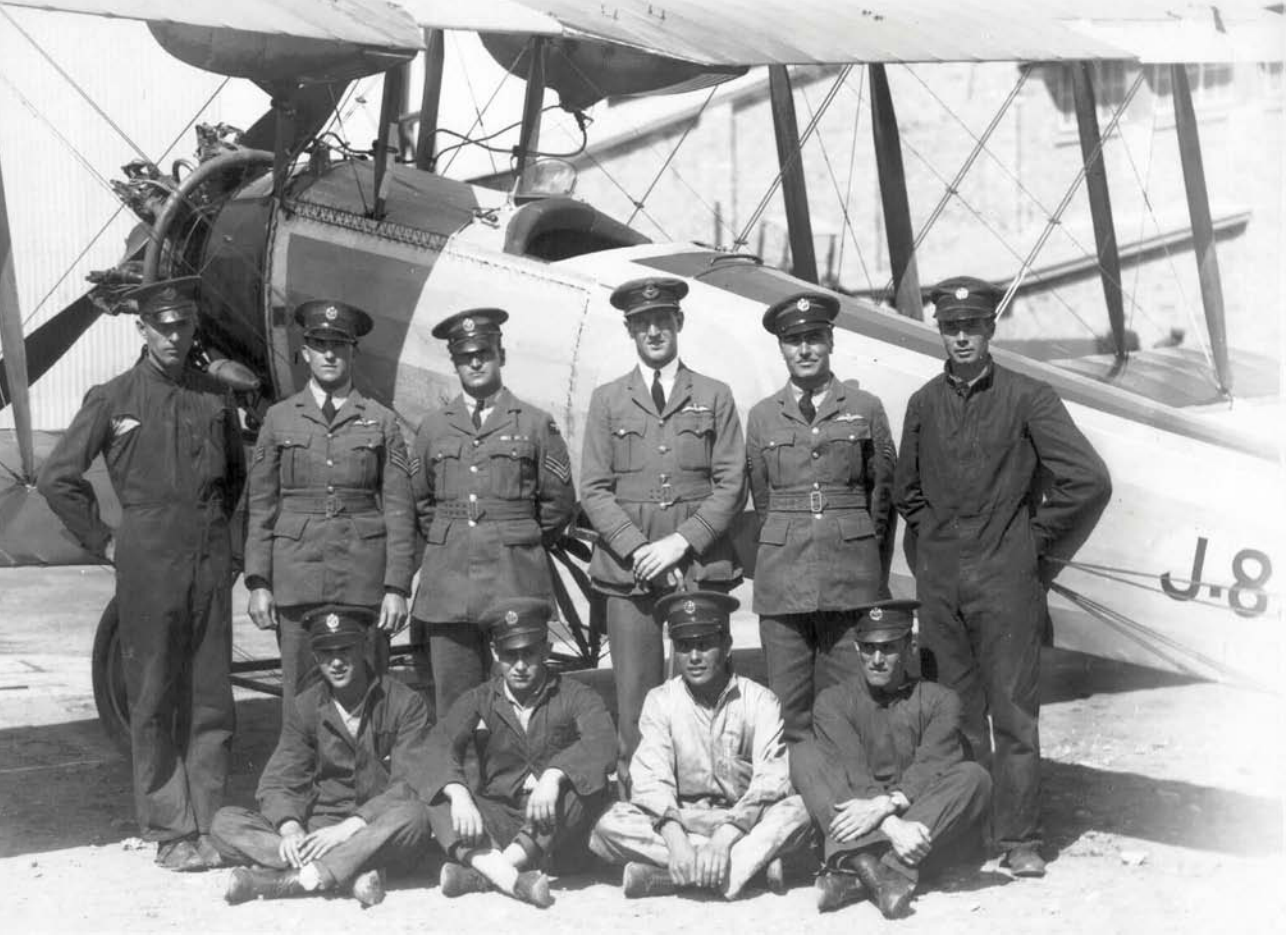
Peter Menzies, the younger of Duncan's two sons, recalls what happened on the voyage home: "My father sailed home on the same ship as the Prince of Wales and his party. The Prince learned that my father had delayed his leave and that he was returning home on the same ship, and invited him to dinner one night. The RAF personnel were all berthed below the waterline, and the stewards would turn them away from the First Class bars. When Duncan went to dinner with the Prince, the stewards tried to turn him back too!" Fortunately, Menzies was able to persuade the stewards, and later recalled that the Prince was "absolutely charming".

Peter continues: "The Prince was very interested in what the life of a young RAF officer was like. He questioned my father closely, because he was a modern young man. My father said, 'I love it but I'm a bit fed up. I've been in the RAF for donkeys' years and I've only flown two or three types of aircraft'. The Prince of Wales said to him, 'What would you have to do to fly more different types of aircraft?' And Dad said 'I'd have to get a posting to Martlesham Heath [home of the Aeroplane & Armament Experimental Establishment], and be able to start test-flying'." At the time, nothing more was said about a career in test-flying, but in later years Menzies would wonder if the Prince had taken a more direct interest in his career. In any event, the young pilot had by now clearly marked himself out as among the cream of the crop.

On returning to the UK, Menzies was posted to the Central Flying School (CFS) at Wittering, to train as a flying instructor. He arrived on May



MENZIES FAMILY COLLECTION



MENZIES FAMILY ARCHIVE

ABOVE ***Flying Officer Menzies (third from right, standing) poses with a group beside an Avro 504N, a type on which he established a reputation as a "crazy flying" specialist. The 504N was an updated 504K, with the latter's rotary engine replaced with an Armstrong Siddeley Lynx radial engine, hence being known as the "Lynx-Avro".***

20, 1930, and immediately began the intensive course that would enable him to teach tyro pilots. The course involved forced-landing practice, learning about the effects of the controls, aerobatics, spinning and so on. During the course he flew Avros, Bristol F.2Bs and an Armstrong-Whitworth Siskin.

CRAZY FLYING

On July 15 the same year he underwent a test at the hands of Sqn Ldr Whistler, the officer in charge of the CFS. Two weeks later Menzies participated in the Clarkson Trophy for inter-Flight aerobatics, the oldest flying trophy competed for at the CFS. At the beginning of August, he was rated "exceptional" by the CFS, a rare accolade and a further indication that Menzies was among the best of his peers.

That September Menzies returned to Egypt to take up a posting with the Communications Flight of the Heliopolis HQ Station Flight, flying Fairey IIIs and Avro 504Ns. Staying only a month, he was posted back to No 4 FTS as an instructor. Menzies had by now developed a flair for aerobatics, and in addition to his duties as an instructor, some of his time at Abu Sueir was spent in honing this skill. In February 1931 he began preparations for a "crazy flying" routine for the RAF display to be held at Heliopolis.

Such air displays were a way in which the usually modest Menzies could let his flying do the talking — almost literally, according to an effusive newspaper report of his performance at Heliopolis on February 12, 1931. The *Egyptian Gazette* wrote: "The most popular event on the programme was crazy flying by Flt Lt F.K. Damant and Fg Off D. Menzies, in Avro Lynxes [sic]. These two pilots did everything with their machines except make them talk. It was amazing to see what a 'plane could stand.

"Evolutions which looked as though they must snap the machine in half were carried out again and again. The skill of these two pilots was almost uncanny; they seemed almost part of their 'planes, and the 'planes were nearly human in the way they responded to the controlling hand. At one time the 'planes did a little dance along the ground in front of the spectators". The performance was evidently popular, as Menzies repeated it at the following year's RAF Air

TAH ARCHIVE

ABOVE ***Menzies' move to the Aeroplane & Armament Experimental Establishment at Martlesham Heath in the spring of 1933 enabled the 27-year-old to get his hands on the most advanced types of the day, including the sleek Hawker Hart light bomber. Hart J9937 spent time at the A&AEE and was probably flown by Menzies while there.***

Display at Heliopolis, and again in May at Gezira for Empire Day.

In October 1931 the second experimental Fairey Long Range Monoplane undertook a proving flight to Abu Sueir ahead of its attempt on the world distance record. Menzies evidently took an interest in the machine when it visited Egypt, as he was photographed with it. He would later be responsible for a number of experimental types produced by that company.

At the end of 1932 Menzies was posted home where he would take up a post as test pilot with the Aeroplane & Armament Experimental Establishment (A&AEE) at Martlesham Heath — exactly as he had suggested to the Prince of Wales two years previously. On returning to England, Menzies went first to the Home Aircraft Depot at Henlow in Bedfordshire, where the Officers' Engineering School was located, to bolster his technical knowledge before becoming a test pilot.

In April 1933 Flt Lt Menzies took up his post at the A&AEE. If his hope had been to fly a greater variety of aircraft types, he was not to be disappointed. In that first month, his logbook records flights in numerous types: Westland Wapiti and Wallace, Hawker Demon and Hart, Bristol Bulldog, Fairey Seal and Armstrong Whitworth Atlas and Aries. His duties were similarly multifarious. The tasks undertaken by Menzies on both service and experimental types included level-speed and climb tests, fuel consumption trials, "windmill" tests, handling with the centre of gravity (c.g.) at different limits, wireless telegraphy and radio telephony tests, checking exhaust-gas buildup, measuring oil cooling, cockpit heating, and assessing experimental equipment. The latter included testing a "flightpath recorder" (an early "black box"), a self-centring tailwheel fitted to a Fairey Seal, an experiment involving sound recordings of a Rolls-Royce Kestrel IIS engine in a Hawker Hart, and a "Vibrograph" (vibration recording) test on a Vickers Vildebeest.

The work at Martlesham also included flying a number of unusual types and assessing their characteristics. One such aircraft was the German Heinkel He 64C sports aircraft, registered G-ACBS, which he flew during September—October 1933. This highly modern

type was purchased ostensibly to assess its Handley Page high-lift devices. However, it must also have been of considerable interest as an indication of German progress in aeronautical engineering at the time. While the low-wing cantilever monoplane was present at Martlesham, the majority of the RAF service types under test were wire-braced biplanes.

TESTING TIMES

Much of Menzies' work involved the development of three new naval torpedo, spotter and reconnaissance aircraft designed to Specification S.15/33, which would ultimately result in the production of the Fairey Swordfish and Blackburn Shark. Throughout the summer of 1934, Duncan flew the prototypes developed by Blackburn (the B-6, registered as such under B Conditions), Gloster (TSR.38, serial S1705) and Fairey (TSR.II, serial K4190) for this role.

Test flying offered risks as well as rewards, as Menzies found out on December 1, 1934, when he flew Wapiti K1129 to Brough to collect the first production Shark, K4349, from Blackburn. Menzies himself later described the flight back:

"I was flying downwind at 600ft in bad visibility with a Wapiti in formation on the starboard side when the engine cut. An immediate gliding turn to port brought into view the only field that was green. It looked to be an impossible proposition but there was no choice. I had to admit to myself that I was undershooting and damned myself for a fool, remembering the number of pupils I had told 'always take the far hedge when your speed has fallen off rather than undershoot and hit the near one'. To my growing amazement it began to look as though I would make it. The Shark was on a light loading and cleared a 6ft hedge hitting the ground within 20yd.

"The aircraft had brakes but they were never used. The wheels sank in the soft ground of winter wheat which provided natural braking up to today's Maxaret standards, and at the end of the run there was just sufficient room to walk between the propeller and the far hedge. The aircraft subsequently continued its journey by road and investigation proved that before this flight the fuel filter had been dropped. It was unknown at the time, but this introduced an airlock into the flow from a tank designed to self-feed into the main collector tank.

"I take no credit for this approach and landing, it just happened. If I had had the extra height I prayed for I would have gone through the far hedge for a certainty."

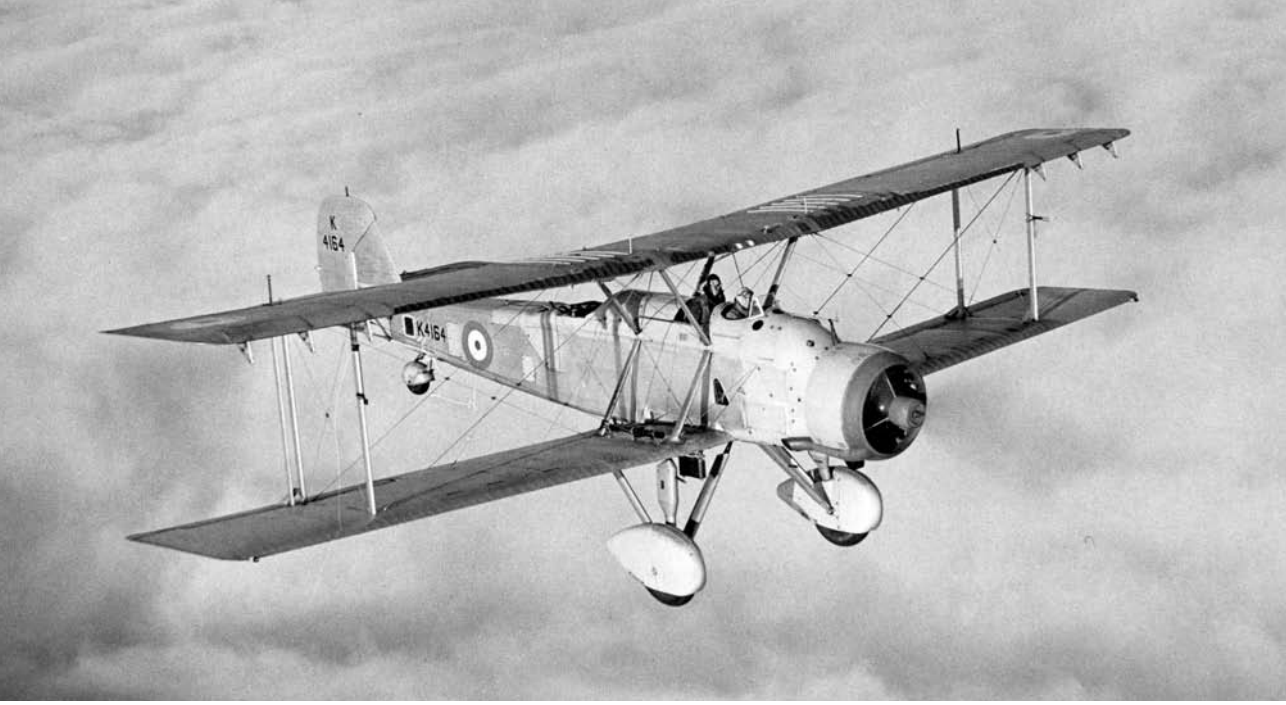
His characteristic modesty aside, the landing was clearly a skilled piece of piloting, and Menzies was commended for this by the brass at Martlesham. As if fate intended to prove this was not a fluke, Duncan was required to pull off a similarly remarkable forced landing just five

INSET: MENZIES FAMILY COLLECTION

INSET ABOVE ***Menzies photographed beside Fairey Long Range Monoplane K1991 in Egypt in October 1931.***

BELOW ***The first production Blackburn Shark, K4349, the aircraft in which Menzies made a skilful forced landing in a field during a ferry flight in December 1934.***

PHILIP JARRETT COLLECTION



ABOVE ***The second aircraft in which Menzies had to make a forced landing after engine failure while at the A&AEE was Vickers Vildebeest III K4164, seen here following its conversion to Mk IV configuration. On January 7, 1935, Menzies experienced engine failure in the aircraft and had to put down in a field near Trimley St Martin in Suffolk.***

weeks later, when the engine of Vickers Vildebeest III K4164 stopped during a test flight in a snowstorm. Once again Menzies made a skilled landing, which won further plaudits from his superiors — but only after he had been forced to defend himself against an engineer's suggestion that he had only claimed the engine had iced up to get himself out of trouble! *[See "*A Very Audible Remark…", *Menzies' own recollections of this incident in* TAH6 *— Ed.]* The station commander at Martlesham wrote on the official report: "I consider [that] Flt Lt Menzies did exceptionally well to bring the aircraft into [a] forced landing without damage. This is the second effort within six weeks and the last was even more skilled". The officer commanding the Performance Testing Section agreed: "It was an exceptionally fine show on the part of Menzies".

Later in 1935 Menzies received a third rating of "exceptional" — a rare accolade. A further indication of the esteem in which he was held came with an unexpected job offer from Fairey Aviation, which had recently lost one of its test pilots, S.H.G. Trower, who was killed in the crash of the prototype Fantôme, G-ADIF, at Evère in Belgium on July 17, 1935. Fairey had evidently been impressed with Menzies' test work at Martlesham on the numerous examples of its aircraft that had passed through the A&AEE, and asked him to take up the post of deputy to chief test pilot Chris Staniland.

Menzies was delighted with the offer, but at the time still had two years to run on his RAF commission. The job offer was open only for a limited time, and Duncan made a strong case to his superiors to be allowed to leave the RAF, in a letter dated July 27, 1935.

"I have just been offered a post as test pilot to the Fairey Aviation Company", he wrote, describing the offer as "literally the chance of a lifetime". He went on: "I have always been interested in test work and the chance offered to me is one for which I am willing to make any sacrifice. I realise that applications to resign from medium-service officers will not be regarded favourably at this time of expansion, yet I venture to suggest that, in the capacity of test pilot to a civil firm, I shall be continuing to serve in a useful capacity to the Royal Air Force for many years, while if I complete my service in the normal manner I shall have to give up flying with the exception of reserve training, and my experience gained in the Service as a test pilot will be wasted".

The Air Council agreed, and on August 24, 1935, Menzies was transferred to the reserve of RAF officers. Two days later, he joined Fairey Aviation as deputy chief test pilot.

NEXT TIME *Matthew Willis profiles Menzies' dazzling career as a test pilot for Fairey, including a hair-raising incident in which a Fulmar came apart during a terminal-velocity dive . . .*

ACKNOWLEDGMENTS *The author would like to thank Mary Ann Bennett, Peter Menzies, David Weston, Duncan Simpson and Manchester Airport archivist Michael Hancock for their help with this two-part series*

SUB-ZERO INC.

Ladd Field & the US Army Air Corps Cold Weather Test Detachment

In 1940 the USAAC's Cold Weather Experiment Station was established at the newly-built Ladd Field, near Fairbanks in Alaska. Created to test aircraft to the very extremes of their operability, the Cold Weather Test Detachment played a vital role during World War Two and beyond. **DAVE STERN** introduces a two-part history of the CWTD with its genesis

AS ALASKA'S 1934 spring "breakup" season progressed, the US Army Air Corps (USAAC) Air Staff selected one of its most promising officers, Lt-Col Henry "Hap" Arnold, to lead a reconnaissance mission to the USA's northernmost incorporated territory. Arnold chose 14 officers and 16 enlisted men to fly ten modified Martin B-10 bombers from Bolling Field, Washington DC, cross-country to the Territory of Alaska (as it was known before its admission to the Union as a State in 1959).

Carrying 365 US gal (1,380lit) fuel tanks mounted in their bomb bays, the B-10s were afforded a reduced number of fuel stops and ranged throughout Alaska, photographing its topography and surveying areas most suitable for the development of future air bases, including an air depot and a cold-weather research facility. The Alaska Flight landed at Weeks Field, Fairbanks, on July 24, 1934, to receive a warm welcome from aviation-savvy citizens eager to inspect the bombers and glean news from the "Lower 48".

The B-10s photographed roughly 21,000 square miles (54,390km²) of Alaska's half a million square miles (1·3 million km²) of uncharted territory, flying parallel courses spaced 20 miles (32km) apart, thus yielding a 20 per cent overlap. Aeronautical charts for Alaska simply did not exist; the only contemporary charts were those made by local bush pilots, who scratched crude maps marked with just enough contour features for the pilots to reach their destinations.

As Hap Arnold continued his rise to General rank, he steadily guided American airpower into preparations for what appeared to be an inevitable global conflict. Along with the

MAIN PICTURE ***A motley collection of USAAC aircraft at the Cold Weather Test Detachment (CWTD) at Ladd Field. Among the types are a Curtiss P-40 and a pair of North American P-51 Mustangs (foreground), a North American AT-6 and Noorduyn Norseman (centre right), a Republic P-47 undergoing maintenance in a shelter, two Curtiss C-46 Commandos, a Consolidated B-24 and Boeing B-17.***

USAF VIA AUTHOR

RIGHT ***Lieutenant-Colonel Henry Harley "Hap" Arnold in 1935, the year after he had led an expedition of ten Martin B-10 bombers from Washington DC to Alaska, covering some 8,290 miles (13,340km) and earning Arnold the 1934 Mackay Trophy. Arnold was the driving force behind the establishment of a cold-weather testing station in Alaska.***

USAF

MAP BY MAGGIE NELSON

planning and construction of secret "fishing canneries" — in reality, military bases — in the Aleutian Islands, bases at Elmendorf Field in Anchorage and Ladd Field near Fairbanks were also hastily constructed.

HAP'S PET PROJECT

It was decided to base a personal project of Arnold's — the Cold Weather Experiment Station (CWES) — at the latter. The northernmost of the USAAC's American bases, a mere 110 miles (175km) south of the Arctic Circle, Ladd Field was strategically located in the Territory's central interior, in the Tanana or Golden Valley, populated by 30,000 people who endured winter temperatures which could plunge to -70F° (-56°C) . In 1935 controversial air-power advocate Brig-Gen Billy Mitchell made a characterically forthright — and prescient — statement: "I believe that in the future, he who holds Alsaka will hold the world". Mitchell was a tough experienced outdoorsman who had been responsible for the construction of Alaska's Washington—Alaska Military Cable & Telegraph System (WAMCATS) during 1900–04, which enabled communications between Valdez in southern Alsaka and Seattle. Congress apparently listened to Mitchell, despite his having resigned from the USAAC following his court-martial ten years earlier, and in 1935 the Wilcox National Air Defense Act was passed, authorising the construction of new air bases, including one in Alaska for cold-weather testing and training. Although funding was not allocated for this new base, planning commenced nevertheless.

Surveys were undertaken in July and August 1936 for a suitable site near Fairbanks, and in March 1937 six square miles (15km²) east of Fairbanks, along the Chena River, were allocated for the new air base. Funds were released for

The Curtiss XP-37 was essentially a modified P-36 with an inline engine. The prototype, seen here, made its first flight in April 1937. The aircraft was fast, reaching 340 m.p.h. (547km/h), but the pilot's view forward was poor and the turbocharger proved troublesome. Nevertheless 13 YP-37s were ordered and delivered in March 1939. ALPHA ARCHIVE

the airfield's construction, largely thanks to the advocacy of Hap Arnold, and preliminary work began in late August 1939. The new airfield would be named in honour of Maj Arthur K. Ladd, an Air Corps pilot who had been killed in a crash in South Carolina in December 1935.

In September 1940 Ladd Field was declared operational, although its main hangar and workshops were still incomplete. By this time the war in Europe was a year old, and defence of the airfield was provided by L Company from the US Army's 4th Infantry Division and Battery H of the 206th Coast Artillery, both of which were also participating in cold-weather testing of weapons and clothing.

The CWES's Commander, Lt-Col Dale V. Gaffney, guided his men, appropriately dubbed "blue-noses" or "cold-nose boys", into action with a bare minimum of equipment, which had to be shipped north on the government-run Alaska Railroad. Undaunted, Gaffney was ready to commence work at Ladd by the end of 1940. The first aircraft assigned to the base was a Douglas O-38F Owl, which made a forced landing some 70 miles (110km) south-east of Fairbanks after engine failure on June 16, 1941. The crew, 1st Lt Milton Ashkins and Sgt R.A. Roberts, were unhurt and hiked to safety after receiving air-dropped supplies. (The Owl was recovered in 1968 and is now on display at the Museum of the USAF in Dayton, Ohio.) Two Boeing B-17Bs arrived shortly after the O-38, along with a pair of Curtiss YP-37A fighters.

Six of Arnold's Martin B-10s are inspected at a primitive airfield in south-east Alaska during the 1934 expedition to the far north. The ten B-10s were collectively worth some $518,000. USAF

The purpose of the CWES was to determine methods of adapting and operating USAAC bombers, fighters and transports in Arctic weather conditions down to -65°F (-54°C) and included the creation and testing of ground-support equipment and clothing — anything the USAAC needed to conduct Arctic combat operations. By the end of the first season the total number of personnel on site had grown to 520.

The work was not without its mishaps and tragedies. One of the YP-37s, serial 38-341, was groundlooped by pilot G.E. Cranston on April 8, 1941, resulting in the fighter being written off. The other, 38-481, sat idle for a two-month period awaiting a new engine from the USA. Worse, one of the B-17Bs was lost in a crash in Nevada on February 6, 1941, while flying CWES documents to Wright Field in Ohio via Sacramento. All eight crew were killed; in tribute their names were used for roads back at Ladd.

The original plan had been for the CWES to receive two fully winterised examples of every type in the USAAC inventory for testing under field conditions — but history intervened on December 7, 1941, when the Japanese forced the

NORM TAYLOR COLLECTION VIA AUTHOR

ABOVE ***Serial 38-481, the tenth of the 13 Curtiss YP-37As delivered to the USAAC, is assembled at Ladd Field after its delivery in 1941. The aircraft operated with the CWTD for four months, but the sub-zero temperatures in which it was operated took their toll, and it was was out of commission for two months awaiting a new engine.***

USA into the war with its attack on Pearl Harbor. Testing at the CWES was considerably disrupted and in February 1942 the Cold Weather Test Detachment (CWTD) was established as a separate flying unit, comprising 38 officers and 180 enlisted men. The Base Detachment of six officers and 70 enlisted men was responsible for the day-to-day running of the base.

COMBAT OVER THE ALEUTIANS

In June 1942 the Japanese bombed Dutch Harbor on Amaknak Island in the Aleutian Islands and occupied Kiska and Attu Islands, forcing Alaska Command to transport any available troops (CWTD crew included) into the wildly fluctuating Aleutian weather. During their short interlude CWTD personnel quickly learned what others based in the Aleutians unanimously agreed upon — weather was their first enemy, the Japanese coming a poor second.

The CWTD was disbanded in June 1942 and its airmen sent to participate in the defence of the region, some being assigned to the 36th Bombardment Squadron on Umnak Island and the remainder to Nome on the coast north-west of Ladd Field. Over the next four months CWTD personnel distinguished themselves in combat and earned various decorations, including the Distinguished Flying Cross, Legion of Merit, Purple Heart and Air Medal. Three CWTD airmen were killed on operations in the Aleutians, and three more were lost when a Douglas B-18 crashed into an ammo dump

LADD FIELD & THE ALSIB ROUTE

IN 1942 LADD Field became the busy bilingual hub for an alternative "back-door" delivery route to the Soviet Union for desperately needed American Lend-Lease aircraft, which up until that point had been transferred along a Miami—South America—Africa—Iran—Russia air-sea route. Ladd would be at the centre of the Alaska—Siberia delivery route, known to the Americans as the ALSIB project and to the Russians as the Alaska—Krasnoyarsk route.

American pilots would ferry brand new aircraft from their factories to the route's starting point at Great Falls, Montana, from where they would continue their journeys through western Canada along the pre-war Northwest Staging Route, into the Alaskan interior. At Ladd the aircraft would be handed over to Soviet pilots who would fly them on to Galena, Moses Point and Nome and across the Bering Sea to Uelkal, from where they would continue through Siberia to Markova on the Anadyr River. From there they would then be sent to their front-line units.

The first delivery of Douglas A-20 Havoc light bombers for the Soviet Union arrived at Ladd in September 1942 and were handed over to Russian pilots once their "squawk sheets" had been cleared as per Russian specifications.

By the end of the war, more Lend-Lease aircraft had been delivered via the ALSIB route than by all other routes combined; nearly 8,000 aircraft — including Bell P-39s and P-63s, Curtiss P-40s and (one) C-46, Douglas A-20s and C-47s, North American B-25s and AT-6s and Republic P-47s — had been transferred by September 1945. **DS**

NORM TAYLOR COLLECTION VIA AUTHOR

ABOVE ***The CWTD's Commanding Officer, Dale V. Gaffney (third from left), is interviewed beside a B-17B by radio journalist Bud Foster of Fairbanks-based radio station KFAR. Note the CWTD's motif — a polar bear holding a bomb — applied to the B-17B's fuselage. Gaffney was awarded the Army Distinguished Service Medal in 1946.***

near Nome. By the end of the summer of 1942, however, the CWTD had been reactivated at Ladd, with Gen Arnold demanding its permanent establishment.

Dale Gaffney once again took charge of the unit's operations, dividing the Detachment into four flights: Fighter Section; Medium Bomber Section; Heavy Bomber Section and Miscellaneous Aircraft. Other sub-units dealt with supply, armament, ordnance, transport and other specific details. Gaffney also hired a group of local seamstresses and equipped them with sewing machines, tools and materials with which to develop a variety of experimental Arctic clothing.

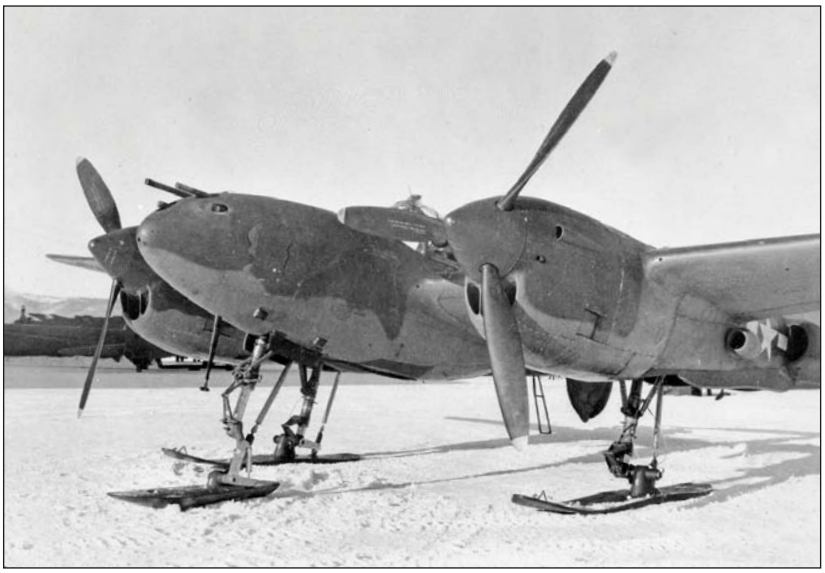
Several famous explorers and mountaineers were sent to give the benefit of their knowledge and experience in this regard too, including Sir Hubert Wilkins (who made the first trans-Arctic fixed-wing flight, in 1928), Lt-Col Ashley McKinley (who accompanied Richard Byrd on the first flight over the South Pole the following year) and the famous mountaineer and geographer Bradford Washburn, who led the 1942 US Army Alaskan Test Expedition to field-test clothing, boots, gloves, tents, mess utensils and new food items on the upper slopes of Mount McKinley (now known as Denali) 120 miles (195km) from Fairbanks.

During 1942–43 Ladd Field became home to 23 technical representatives from some 21 aircraft manufacturers including Bell, Boeing, Consolidated-Vultee, Curtiss-Wright, Lockheed, North American and Republic, as well as component suppliers such as Allison, Bendix and Hamilton Standard. These reps performed troubleshooting of their company's products and forwarded reports to their respective HQs, suggesting product improvements and field modifications for all aircraft at Ladd, including the ALSIB machines (see panel on page 114).

The CWTD crew and the reps soon reached a unanimous conclusion; that the relationship between an airframe, its engine and, most importantly, its ancillary equipment — starters, carburettors, relays, batteries, switches, wiring and hydraulics etc — rarely functioned reliably in unison as a fully serviceable aircraft in sub-zero conditions. Components approved after the usual factory bench tests simply froze or failed during similar tests at the CWTD. Gaffney's aim was to ensure that the USAAC could operate all of its aircraft at temperatures as low as -65°F (-54°C). This was indeed a tall order, but by 1943–44 the CWTD could claim that all aircraft in the USAAC inventory could operate at temperatures down to -40°F (-40°C).

BATTLING THE ELEMENTS

During the winter of 1943–44 temperatures at Ladd plunged to -60°F (-51°C), providing ideal conditions in which to test and modify aircraft and support equipment. Whereas civilian bush pilots performed the winter ritual of "firepotting" their engines — placing a pot with burning gas or stove oil beneath



NORM TAYLOR COLLECTION VIA AUTHOR

LEFT ***A ski-equipped Lockheed P-38 during testing at Ladd Field. CWTD pilot Randy Acord recalled: "I had the P-38 on retractable skis for the whole of March 1944, and I made 165 take-offs and landings on skis . . . sliding 7,000ft [2,130m] on each landing".***

BELOW ***An early aerial view of Ladd Field looking south, with the serpentine Chena River looping across the northern end of the airfield. The most notable feature is the large hangar at the eastern end of the runway. Several B-24s are just visible on the ramp.***

the engine and covering it with a tarpaulin — the CWTD developed mobile heating units designed to pump hot air through two or three 14in-diameter ducts fed into the engines and cockpits of its aircraft. Generating 250,000 Btu or higher, the early units were called jeep-heaters, space-heaters or surface combustion heaters; most groundcrew simply called them Herman-Nelsons, after the name of the well-known heater manufacturer.

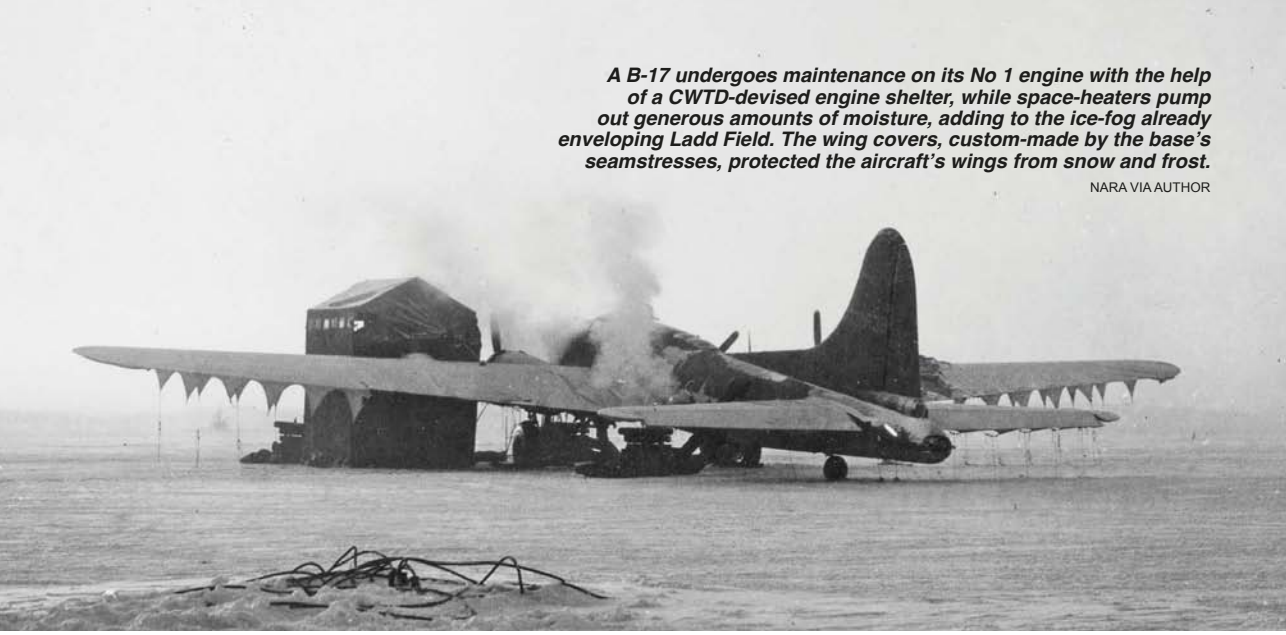
Burning low-octane gasoline, the heaters drove blower fans to move hot air through the ducts to warm oil tanks, carburettors and hydraulic propeller-feathering mechanisms. If performed properly by a well-drilled crew using several heaters simultaneously, the average warm-up for a bomber was approximately 30–60min.

Other innovative cold-weather aids included electric oil-tank heaters and a readjustment of the Allison V-1710 engine's anti-freeze mixture to 93 per cent anti-freeze, with enough water to prevent it becoming slush. Other innovations were a shelter for single-engined aircraft, with canvas flaps that enveloped the engine, and larger "nose-docks". Pumping heat from a space-heater into this confined space allowed mechanics to repair or replace an engine more efficiently, without suffering from frostbite.

When blowing-snow and frost infiltrated undercarriage wells and engine cowlings, the ladies in the fabric shop made patterns for engine, cockpit, wing and tail covers to prevent frost and snow buildup. Wheeled hardstands were also built so groundcrew members could work on each side of an engine simultaneously.

Sharp chunks of ice on ramps and runways played havoc with standard thin-ply aircraft tyres, forcing the USAAC to develop multi-ply tyres with a special tread pattern embedded with spring or steel cleats to grip snow- and ice-covered runways and taxiways. In addition, Air Materiel Command demanded that a new oil be developed for cold weather use; thus AN-05 Grade 1100A was successfully tested on CWTD

NARA VIA AUTHOR



A B-17 undergoes maintenance on its No 1 engine with the help of a CWTD-devised engine shelter, while space-heaters pump out generous amounts of moisture, adding to the ice-fog already enveloping Ladd Field. The wing covers, custom-made by the base's seamstresses, protected the aircraft's wings from snow and frost.

NARA VIA AUTHOR

and ALSIB aircraft, as it maintained a constant viscosity at low temperatures without breaking down, or when diluted with aviation gasoline, another method of forcing a cold-soaked engine start during early-morning sub-zero temperatures without heaters.

Moisture was the groundcrews' single most formidable enemy, accumulating in the fuel and hydraulic systems and radio equipment during an aircraft's transit from a warm hangar into sub-zero temperatures. Crew chiefs were drilled to open petcock drains regularly and siphon off the usual accumulation of water. Many ALSIB aircraft passing through were similarly modified at Ladd with extra draincocks added throughout the fuel and oil systems.

CONTINUING CHALLENGES

Another challenge was the splitting open of oil-cooler seams as a cold-soaked engine was started up. The thick congealed oil struggled to circulate and, being incompressible, cracked the weakest area along a solder joint. The oil cooler's tubing either burst or the seams cracked, or both, dumping oil overboard. Ladd records mention a reservoir tank being installed with a surge-valve between the main oil line and the cooler.

Credit is due to the inventive individual who, probably desperate to leave one of the many desolate ALSIB bases along the route, wrapped a length of rope around a propeller hub and tied it to a truck bumper. Pulling away in the truck quickly enough was sufficient to turn the engine over if — and only if — the cylinders and spark plugs were not already soaked with gasoline from a failed cold start.

Wartime aircraft batteries lacked sufficient current flow to crank a cold-soaked radial engine. Standard military batteries performing reasonably well in more temperate conditions failed and froze in the Arctic. The lead plates were too thin and the electrolyte's specific gravity was inadequate for sub-zero weather. As a result, two solutions were applied until new heavy-duty batteries could be manufactured. The first required the batteries to be removed after a mission and fully recharged in a hangar overnight; however, one cold engine start was enough to drain the battery of all of its cranking power, thus requiring the second solution.

Groundcrews constructed towed external battery carts to boost the onboard aircraft battery with enough current flow to start even a cold-soaked bomber's radial engine. Post-war Arctic-based Douglas C-47s, R4Ds, C-54s, Fairchild C-119s, Douglas C-124s (and later even turbine-powered Lockheed C-130s) supplying ice islands

FIGHTING THE DREADED ICE-FOG

ONE OF THE biggest single challenges of operating in Ladd's sub-zero temperatures was working around the minuscule moisture-generated ice crystals that float in still air, creating "ice-fog", demonstrated during joint USAAF–Army "aggressor-defender" exercises, designated as Task Force *Frigid*, around Fairbanks in 1947.

With the outside temperature hovering around -60°F (-51°C), Army troops rapidly burned up calories slogging through deep snow while attempting to defend their positions. One unit called for air support to "strafe" an attacking aggressor force. In response, four P-51 Mustangs were quickly pushed out of a warm hangar at Ladd Field along with four heavily bundled-up pilots, who were squeezed into tight-fitting cockpits to perform a brief flightline warm-up. The engine exhausts generated so much moisture it turned into ice-fog. By the time they had taxied to the runway for take-off, visibility had reduced to zero and the air-support mission was cancelled. **DS**

and remote DEW-Line radar sites, always kept their engines running rather than risk being stuck without ground-support equipment.

Arctic temperatures adversely affected standard aircraft spark plugs of the day. Firing up a cold-soaked engine without pre-heat often resulted in cylinder flooding and fouled spark plugs. The engine simply would not fire up, so mechanics were forced to deal with multiple "wet plugs". The USAAC requested that manufacturers produce a longer-reach spark plug, in which the electrode extended slightly further into a cylinder's combustion area. It also requested they come in various heat ranges.

Savvy local bush pilots used tree boughs, straw or mats beneath their tyres to prevent them freezing to the ground and creating tyre flatspots. There appears to be little evidence that such a method was used for military aircraft, however. Presumably the supposition was that if an aircraft was slowly taxied, the rubber warmed enough to round off the flatspot, a technique often used with Alaska-based cars and trucks. In temperatures of -50°F (-45°C) and lower, the flatspot usually froze in place, and moving an aircraft could pop the tyre bead, resulting in a flat tyre. Reportedly, some ALSIB pilots attempted to take off in Airacobras with nosewheel flatspots, shaking the fighter sufficiently to blow the seals, damage the already-delicate nosewheel strut, lose hydraulic fluid and cause shedding of fuselage parts.

ICE MUSTANGS

In 1945 the Pentagon Air Staff assigned the lightweight North American P-51H Mustang variant to Alaska in the air defence role. Accordingly, it would have to be cold-weather tested. In December 1945, two P-51Hs — serials 44-64511 and 44-64518 — were assigned to Project CW-4-45-3 and flown to Ladd for testing with the CWTD. The Mustangs were tested at temperatures from -31°F to -50°F (-35°C to -45°C), initial taxy trials inducing a thick frost which rapidly covered their bubble canopies, severely reducing visibility. Furthermore, the Simmons engine-control-unit's oil congealed, thus jamming the throttle. A quick burst of heat from a Herman-Nelson worked its magic and the throttle was freed.

Flights up to 35,000ft (10,700m) engendered erratic running from the Packard Merlin, including coolant and oil leaks and a propeller surge when pulling out of a dive. At lower altitudes, with the engine ticking over at 1,600 r.p.m. and 34in Hg manifold pressure, the engine would not throttle up, but smoked and cut out — the CWTD crew never determined the cause of this problem.

Installing a Koehler K-1610-B oil draincock prevented freezing of the crankcase breather system, and applying synthetic PPO-256 Grade 110 lubricating oil with engine pre-heating immediately before start-up worked adequately in sub-zero temperatures. Oil was diluted using a Thompson Centrifuge Pump adjusted to 30 per cent oil dilution without oil dumping overboard during a cold start. Oil pressure gauges were removed and replaced during 25-hour inspections. Koehler K-1700B-2 and Whittaker drains in the main fuel line strainer were found to be superior to standard-issue fuel drains if gasoline was drained 60min after servicing. If water contaminated the gasoline the drains still froze solid, however. Spark-plug gaps were set on one Mustang at 0·016in and 0·020in on the other, with Northeast magneto points set at 0·018in. Only three fouled plugs needed replacing, with normal plug changes accomplished during 50-hour inspections. The plugs were still prone to fouling under excessive engine loads and when started cold without pre-heating.

One of the Mustangs, 44-64518, displayed a bizarre wing anomaly that alarmed the

The Pratt & Whitney R-2800 engines of a Northrop P-61 Black Widow are simultaneously heated by ground heaters at Ladd towards the end of the war. The long lines on the wing covers were used to picket the aircraft during windy conditions.
NARA VIA AUTHOR

NARA VIA AUTHOR

ABOVE ***North American P-51H Mustang 44-64461, named* Ah'm Available*, cruises over a typically snowy Alaskan landscape. Following the successful completion of its cold-weather testing programme at the CWTD, the light-weight P-51H was selected to equip three fighter squadrons in Alaska, the 65th FS being based at Ladd Field.***

groundcrew. For no apparent reason two bulges appeared in the upper starboard wing skins behind the gun-housing compartment; one appeared at wing station 88·25 and the other at 97·25, without popping any skin rivets. The puzzled Detachment engineers concluded that the skins expanded during extreme temperatures; yet this mysterious swelling did not occur with the second Mustang or any other aircraft. It appears that '518 was simply more sensitive to low temperatures than its companion.

Another curious problem with '518 was that its rudder consistently moved out of trim, no matter how many times it was re-rigged. The CWTD airmen were more familiar than most with the expansion and contraction of control-cable systems under extreme temperature fluctuations. Cables would be rigged inside a warm hangar, but immediately shrank to become taut after rolling outside into temperatures of -20°F (-29°C) or lower. This was normal, but on '518, cable re-rigging became a constant nagging chore.

Very low cockpit temperatures required the installation of a 50,000 Btu Janitrol heater that still only barely warmed the cockpit. On one test flight a Mustang pilot cruised around Fairbanks at 25,000ft (7,620m) for 15min with an outside air temperature of -50°F (-45°C). Rigged with military thermometers, the pilot's left leg was recorded at 0°F (-17°C), while his right shoulder read 12°F (-11°C).

Other troubles included tailwheels failing to retract, extend or lock down, and brakeplates and pistons freezing and locking up owing to snow packing around them, thus causing frequent brake-assembly changes. The CWTD crews also swapped the P-51H's standard tyres for Goodyear 27in all-weather-tread tyres. Radio technicians frequently opened up AN/ARC-3 radios to change burned-out 6AKR receiver tubes, which also failed in sub-zero temperatures. The Mustang was a product of warm and sunny California, so the type was indeed a long way from its natural home!

WAR'S END

Once these problems were ironed out by the CWTD, Alaskan Air Command equipped the 57th Fighter Group's 64th, 65th and 66th Fighter Squadrons with P-51Hs and despatched them to Ladd and Elmendorf Fields to operate alongside radar-equipped Northrop P-61 Black Widow nightfighters. Between the two, any intruders would be located and dealt with post-haste.

With the end of the war, cold-weather testing continued at Ladd, but on a much reduced level. The Detachment also used a base at Watertown, South Dakota, for the winterisation of aircraft before they were ferried to Ladd. Post-war demobilisation saw a significant reduction in CWTD staff numbers and, reportedly, at one point the unit had a mere four pilots familiar with the Watertown—Ladd route. New crews were swiftly trained over a two-month period.

The CWTD had provided a vital service during the war, and, although its numbers began to dwindle, its services would still be required for the testing of the new generation of jet-powered aircraft then joining the front line.

NEXT TIME — from turning to burning; the Cold Weather Test Detachment enters the jet age . . .

ARMCHAIR AVIATION

We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from hot-off-the-press publications to reissued classics

American Military Aircraft 1908–1919

By Robert B. Casari; Aeronaut Books, 82936 Plymouth Drive, Indio, CA 92203, USA; available from The Aviation Bookshop, 31–33 Vale Road, Royal Tunbridge Wells, Kent TN1 1BS (www.aviation-bookshop.com); 8¾in x 11¼in (222mm x 286mm); hardback; 752 pages, illustrated; £89.99 + p&p. ISBN 978-1-93588-113-1

SOME WILL REMEMBER this author's excellent but sadly uncompleted series of small softcover books on early American military aircraft. Here is the master volume, a weighty and profusely illustrated tome that should meet the needs of all but the most demanding students of the USA's earliest military aeroplanes. All of the aeroplanes ordered and procured by the US Army and Navy in the Services' early days are meticulously recorded here, and the variety and coverage is truly impressive. Besides the familiar types produced by well-known manufacturers such as Wright, Burgess, Curtiss, Thomas-Morse and the like, there are a great many obscure machines that will be new to a majority of students, including unbuilt projects and those that were built but of which no photographs have been found, such as the enigmatic Stout SX-6 monoplane.

It is hard to open these pages without yielding to the temptation to spend an hour or two just browsing for sheer entertainment. However, the hardcore information is there, covering the origins, ordering, testing and service use of an enormous assortment of aircraft. A useful "Overview" of the early development of American military aviation is followed by the main section of the book, covering types manufactured or assembled in the USA and Canada. Then come three smaller sections for aircraft procured from England, France and Italy. In the back there are 14 useful appendices providing details on a variety of allied subjects, a bibliography, a most interesting account of "Government Investigations, Reports and Hearings", colour artwork profiles of 38 aircraft by Bob Pearson and *TAH* Editorial Board member Juanita Franzi, a photo addendum of United States Air Service aircraft in Europe, and an index. There are more than 1,000 photographs and drawings, well reproduced and provided with informative captions.

One needs to familiarise oneself with the way things are arranged. For example, entries for the Royal Aircraft Factory S.E.5a will be found under "Curtiss S.E.5a" in the main section and also under the original designer in the section on aircraft procured from England, and the Avro 504 also appears in both sections. The Sopwith 1½-Strutter, however, appears only in the section for aircraft procured from France.

This is an expensive book, but it is an outstanding work and well worth the investment.

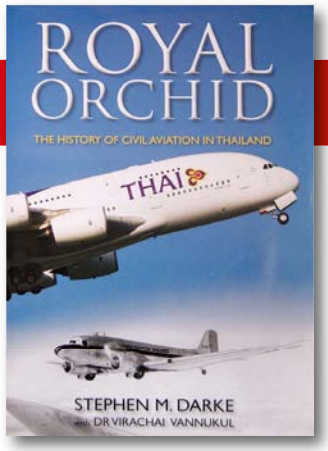
PHILIP JARRETT

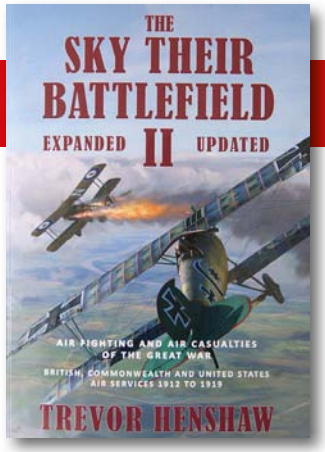
Royal Orchid: The History of Civil Aviation in Thailand

By Stephen M. Darke and Dr Virachai Vannukul; Air-Britain, Causeway House, Chiddingstone Causeway, Tonbridge, Kent TN11 8JP; 8½in x 12in (216mm x 305mm); hardback; 272 pages, illustrated; £29.95 to Air-Britain members, £42.50 to non-members. ISBN 978-0-85130-439-7

GIVEN THAT MOST people will only ever need one book on the history of civil aviation in Thailand — if that many — this is by far the most authoritative and exhaustive volume ever published on the subject, with Air-Britain doing its customary excellent job in bringing together everything and anything in one handsomely appointed package. Co-authors Stephen Darke and Dr Virachai Vannukul are both well-known authorities on the subject, the former being a highly respected specialist on south-east Asian aviation history and the latter having spent his entire career in the Thai airline industry.

Covering nearly 200,000 square miles





(518,000km²), Thailand — or Siam as it was known until June 1939 — has long been a nation attracted to the aeroplane, its first association with the flying-machine being forged in January 1911 when French aviator Charles Van Den Born spent a week at the Royal Bangkok Sports Club with his Henry Farman biplane. The French connection continued with the training of Siamese pilots in France the following year, these returning with Breguet biplanes and Nieuport monoplanes in late 1913, as described in *Royal Orchid's* introductory chapter, which provides a useful gallop through the development of aviation in Siam from this point. Dr Vannukul acknowledges in his foreword, however, that for a more in-depth account of the early years one should look to Edward M. Young's *Aerial Nationalism — A History of Aviation in Thailand* (Smithsonian, 1994).

Where *Royal Orchid* really kicks into gear is with the birth of the post-war civil routes, the subject of the first numbered chapter. In typical Air-Britain style, excellent paper is used, the reproduction of the photographs is good and the extensive use of maps and other memorabilia, some extremely rare, adds a great deal to the story as it is told. This high standard is maintained over the next 15 chapters, throughout which the development of civil aviation in Thailand is narrated with the help of copious data boxes and rare photographs. The sheer volume of meticulously researched detail is remarkable, and it is extremely unlikely that *Royal Orchid* will ever be surpassed as the definitive history of the subject.

There are minor niggles — the grammar is clumsy in places (the use of the plural when discussing an individual organisation; "they" instead of "it" etc) and the writers lack a sense of narrative rhythm — but it seems churlish to nitpick when there is such a wealth of information contained herein.

Of particular value are the comprehensive appendices, which include airline/operator fleet listings, Thai Airways/Thai International statistics, airfield data and, most impressive of all, the complete Thai civil register, much of which was pieced together from handwritten documents which have since been destroyed.

Although it could have done with a slightly heavier editorial hand, this is nevertheless another magnificent achievement for Air-Britain, whose dedication to even the most obscure tributaries of aviation history is to be thoroughly commended. For details of how to join Air-Britain — and if you haven't already, you should — visit the website at www.air-britain.com.

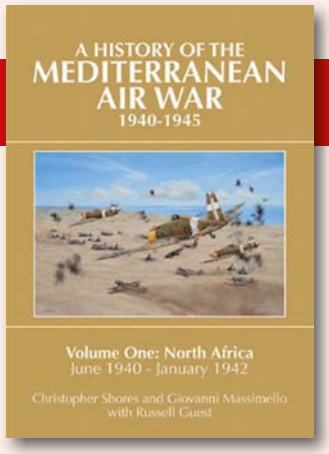
NICK STROUD

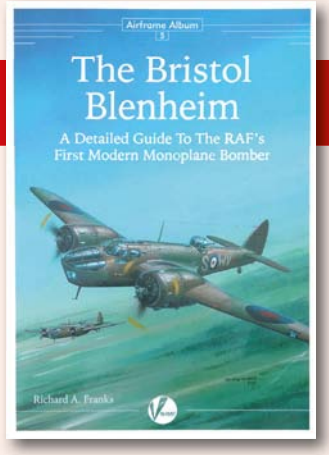
The Sky Their Battlefield II — Air Fighting and Air Casualties of The Great War

By Trevor Henshaw; Fetubi Books, 14 Thornton Road, High Barnet, Hertfordshire EN5 4JE (http://theskytheirbattlefield2.com); 8½in x 12in (216mm x 305mm); 465 pages, illustrated; softback (ISBN 978-0-99297-711-5) £40 + p&p; hardback (ISBN 978-0-99297-710-8) £50 + p&p

WHEN THE FIRST edition of this book appeared in 1995 it was hailed as the prime reference on First World War British, Commonwealth and United States air service combats and casualties. This Mark II version, courageously self-published by the author, is so greatly updated, revised and expanded that it is effectively a new book.

Whereas the first edition contained 10,800 names of air personnel, the stories of 16,800 Allied air personnel are now told, and 13,500 casualties are described. Almost 6,000 entries have been updated or revised, and these are helpfully indicated to aid research. In addition, the everyday events and air combats in all theatres have been checked and expanded, and more than 4,500 new names have been added in an Accidents Addendum that embraces all accidents





on all active war fronts from 1912 into 1919. Moreover, well over 3,000 German claims are linked with Allied losses. Three 16-page glossy-paper sections contain 289 photographs, many of which appear in print for the first time.

This formidable, ambitious and impressive work is an essential reference for any student of the First World War in the air. It renders the first edition defunct, and any researcher or author who fails to use it, or persists in relying upon the earlier edition, risks significant errors or omissions. The author deserves high praise for his devotion and perseverance in producing what must inevitably be the most essential and useful reference work on the role played by Allied aviation personnel in the Great War, and his book pays tribute to the sacrifices made by so many. This is truly a volume that any serious student cannot afford to be without.

PHILIP JARRETT

A History of the Mediterranean Air War 1940–1945, Volumes One & Two

Volume One by Christopher Shores and Giovanni Massimello with Russell Guest; hardback; 560 pages, illustrated; £40; ISBN 978-1-90811-707-6.
Volume Two by Christopher Shores and Giovanni Massimello with Russell Guest, Frank Olynyk and Winfried Bock; hardback; 736 pages, illustrated; £50; ISBN 978-1-90916-612-7. Both 7½in x 9in (190mm x 228mm). Grub Street, 4 Rainham Close, London SW11 6SS

THIS IS NOT just an update of *Fighters over the Desert* (Arco Publishing, 1969) co-written by Christopher Shores and Hans Ring more than 40 years ago. It is a fresh appraisal of the Allies' Western Desert and Tunisian campaigns. In addition to the fighter war, detail is included of the bombing campaigns, reconnaissance and transport aircraft and their supporting units.

Volume One covers the initial 19 months of the air war over the Western Desert from June 1940 to January 1942. Volume Two resumes the story as the British Eighth Army is forced back to the Gazala region, and covers the lull before its defeat in June 1942 and the loss of the port and fortress of Tobruk. These opening volumes are designed to be read in conjunction with the author's previous series of books of the Mediterranean air war, also published by Grub Street. Comprehensive indices and cross-referencing with these books and volumes covering other campaigns enables the reader to follow the involvement and progress of squadrons or individual airmen.

With 560 and 736 pages respectively, these are bulky volumes. The day-by-day format that has worked well in Christopher Shore's previous books is mostly used, with lists of the relevant claims and casualties at the end of each day's summary. The coverage of some aspects such as the RAF's night-bombing operations and the Axis aerial attacks on Egypt are presented in separate chapters. Some may find this disruptive to the chronological flow but it enables the main chapters to be presented in a clear and flowing manner. The narrative is enlivened with many first-hand accounts by commanders and airmen and illustrated by plenty of relevant and well-reproduced photographs, many of which this reviewer has not seen before.

It is probably inevitable that, especially in an undertaking as vast as this, some details will be anomalous with other sources. For example, the Blenheims on p14 of Volume One are captioned as belonging to No 113 Sqn, but their "VA" codes identify them as No 84 Sqn aircraft; Spitfire ER228 pictured on p533 of Volume Two is a Mk Vb, not a Mk Vc, and the Breda 65 was not "armed with four 12·7mm" as stated on p17 of Volume One, but had a pair of 12·7mm machine-guns and two 7·7mm machine-guns. These are the sort of details that will no doubt be corrected in subsequent editions, and they should not spoil or detract from the quality of these books. The

KENNETH G. MUNSON AMRAeS ARHistS, 1929–2015

KENNETH GEORGE MUNSON, Deputy Editor of what is now *IHS Jane's All The World's Aircraft: Development and Production* during 1990–2014, died peacefully on January 2, 2015. Ken joined the compiling team of *Jane's All The World's Aircraft* (*JAWA*) in 1968, becoming its Assistant Editor in 1973 before being promoted to Deputy Editor.

On completing his education at Eltham College in London, Ken worked for the Air Ministry during 1945–59, most importantly on the *Joint Services Aircraft Recognition Journal*, turning to aviation journalism as a career at the dawn of the 1960s. It was through his work on Ian Allan's "abc" series of softbacks, following a recommendation from J.W.R. Taylor, that many readers first came across the name "K.G. Munson", the first being *Enemy Aircraft (German and Italian) of WWII*. Ken went on to curate many more volumes for the abc series, which was later compiled into a hardback. He went on to become the author of more than 40 books and numerous partworks on various aspects of aviation, past and present. As well as Ian Allan, Ken worked with Blandford Publications, Profile Publications and Putnam Aeronautical Books.

Ken was among that illustrious gang of post-war aviation writers — Michael J.F. Bowyer, John Fricker, William Green, Bill Gunston, Alan W. Hall, John D.R. Rawlings, Gordon Swanborough and, of course, John W.R. Taylor — that inspired two, if not three, generations, a fact acknowledged by his peers in July 2012, when Ken was given a Lifetime Achievement Award at the inaugural Aerospace Media Awards, held at the Royal Aeronautical Society in London. **MICHAEL J. GETHING**

formidable amount of information contained herein categorises them as a reference source but they are also highly readable accounts of aerial combat in the Mediterranean theatre. This reviewer looks forward to the publication of the subsequent volumes in the series, intended to cover the Sicilian, Italian and Aegean campaigns.

GARY BARTLETT

Airframe Album No 5: The Bristol Blenheim

By Richard A. Franks; Valiant Wings Publishing, 8 West Grove, Bedford MK40 4BT; 11¾ x 8¼in (297 x 210mm); softback; 132 pages, illustrated; £16.95. ISBN 978-0-95758-665-9

SUBTITLED *A DETAILED Guide to the RAF's First Modern Monoplane Bomber,* this informative volume is aimed squarely at modellers but contains much of interest to the general reader too.

Divided into four main sections — *Technical Description, Evolution, Camouflage & Markings* and *Production* — the book provides a level of airframe detail which is the lifeblood of the obsessive scale modeller. After a ten-page potted history and two pages of specification data, the technical description drills under the skin of the Blenheim, examining the inside and outside of the aircraft from every angle. It does this by juxtaposing wartime keyed photographs and diagrams from the official *Air Publications* (RAF manuals) with other archive pictures and good-quality recent colour photographs taken inside and around the recently-flown Duxford-based Blenheim Mk I, L6739/G-BPIV. Retractable handholds, pneumatic brake lines, trim-tab linkages, a delightfully unexpected gleaming chrome undercarriage-warning horn behind the pilot's seat, engine mounts, the dorsal gun turret and its contents — it seems impossible to find any detail that has escaped scrutiny. OK, electrical-system wiring diagrams are not included; but they are not relevant for the modeller, only the restorer.

Another element of the book which demonstrates that illustrations can be worth a thousand words is the *Evolution* section, in which a series of three-quarter perspective drawings of the aircraft, all from the same viewpoint, show the differences between the many variants. So, for instance, the sole Blenheim PR Mk I had a metal nosecap replacing the glazing, the turret was deleted and the wingtips squared off; the mid-production licence-built Finnish Mk IV had spinners (usually), a second wing-mounted machine-gun, no venturi on the fuselage, small additional glazed portholes above the wing centre section, and bulged landing-lights. All very intuitive and graphic, and much easier to make sense of than wading through reams of text. And a sense of humour is evident too — the same viewpoint is used for a drawing of the post-war Blenheim Electric Car which provided the nose section for the airworthy Mk I.

The *Camouflage & Markings* section begins, perhaps surprisingly, with ten pages of text on RAF schemes (albeit illustrated with black-and-white photographs), but this provides a useful explanantion of what changed and when. This and a similar chapter covering foreign service are complemented by fine-quality colour side- and plan-view artworks by Richard Caruana.

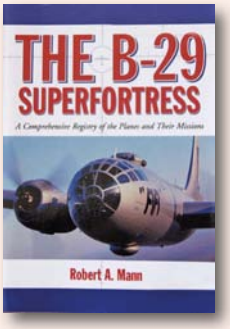
A final section on production is essentially a list of serials tied to manufacturers; it is followed by appendices listing Blenheim kits and resin/white-metal/etched-brass accessories, plus transfer sheets (we don't say "decals" in *TAH*), and a bibliography.

The only possible improvement to this splendid book would be a set of scale drawings, to make it a one-stop shop for the flying scale scratchbuilder as well as for the kit modeller/converter. Otherwise, it is first-rate in every way.

MICK OAKEY

BOOKS IN BRIEF

A quick round-up of what else is currently available for the aviation history enthusiast



THE B-29 SUPERFORTRESS
Robert A. Mann
McFarland & Co Inc; ISBN 978-0-78644-458-8; RRP £32.50

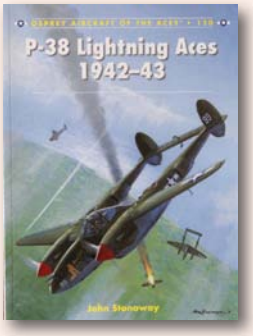
THIS EXEMPLARY reference book covers every conceivable detail pertaining to the mighty Boeing B-29 Superfortress, from production to combat and beyond. The largest part of the text is made up of a master list of the serial numbers of every example built, followed by block number info, variant details and wartime mission lists, as well as the type's use in Korea and Strategic Air Command; the RAF's Washingtons are also covered. The alphabetical list of individual aircraft names is invaluable. This is everything you'll ever need on the B-29, from *The Able Fox* to *Zero Avenger*. **NS**

REPUBLIC F-84E & G THUNDERJET IN ROYAL DANISH AIR FORCE SERVICE
Ole Rossel
Stoppel Forlag; ISBN 978-8-79132-701-8; RRP 395DKK (approx €52)

IN 1951 THE Royal Danish Air Force (RDAF) received its first six Republic F-84E Thunderjets, the type going on to become a cornerstone of Denmark's post-war defences. This excellent English-language book, copiously illustrated with photographs from the RDAF archives, colour artworks and accurate scale drawings on high-quality paper, amply shows that offerings from smaller publishers can be every bit as good as, if not better than, those from the big boys. **NS**

***LE TRAIT D'UNION*: LES 20 PREMIÈRES ANNÉES DVD**
Available from Air-Britain, www.air-britain.com; £19.95

TAKING ITS NAME from the French word for Air-Britain's jealously-guarded hyphen, *Le Trait d'Union* is the bi-monthly historical aviation research magazine formed by the *Branche Française Air-Britain* in September 1968. Part of Air-Britain's extensive CD and DVD programme (which includes extremely useful collections of early and hard-to-find Air-Britain publications — now up to Volume 4), this is an indexed compilation of every issue of the French-language magazine from Issue 1 to Issue 122, published in November 1988. Although not an æsthetic masterpiece, *Le Trait d'Union* is an exceptional source of hard information and well up to the high standards set by its British *frères*. **NS**



P-38 LIGHTNING ACES 1942–43
John Stanaway
Osprey Publishing; ISBN 978-1-78200-332-8; RRP £13.99 (paperback), £7.99 (e-book)

THE FIFTH VOLUME by John Stanaway in Osprey's bar-setting *Aircraft of the Aces* series details the American airmen who used Kelly Johnson's twin-boom fighter to achieve five kills or more during the type's first full year of combat. As usual for this publisher, the amount of info crammed into each volume is impressive, the photographs are well-reproduced and the artworks by Osprey veteran Chris Davey are first-rate. Got storage issues? The e-book version is well worth investigating. **NS**

AIRCRAFT AND AEROSPACE MANUFACTURING IN NORTHERN IRELAND
Guy Warner and Ernie Cromie
Colourpoint Books; ISBN 978-1-78073-060-8; RRP £8.99

The third of this ever-dependable two-man team's landscape-format books on Northern Ireland's rich aviation history; once again, this is superb value for money in a lovingly-crafted volume jam-packed with stories and info. **NS**

SUITCASES, VULTURES AND SPIES
Mark Hillier
Yellowman; no ISBN; RRP £20

THIS ADMIRABLE self-published book tells the story of Wg Cdr Thomas Murray DSO DFC*, who began his war on Handley Page Hampdens in 1940, before going on to become the CO of No 138 (Special Duties) Sqn at Tempsford, the work of which included dropping spies and supplies into Nazi-occupied Denmark and Norway. Containing numerous previously unpublished photographs over 145 pages, *Suitcases . . .* is an absorbing, well-told account of one man's war. **NS**

Lost & Found

PHILIP JARRETT explores the lesser-known corners of aviation history, discovering unknown images and rediscovering long-lost details of aircraft, people and events. Here he discovers what happened to a little-photographed pleasure-flying Avro 504K in 1920

THERE WERE LOTS of surplus ex-military Avro 504Ks around at the end of the First World War, and when the First Aviation Exhibition at Amsterdam (ELTA) was held in 1919 the Avro Company, as the main provider of pleasure flights at the event, sent across ten aeroplanes to perform display and joyriding duties. These included five 504Ks, one of which was G-EAJQ, ex-H2587 from a batch of 500 ordered from the parent company towards the war's end.

Having been granted its Certificate of Airworthiness on August 20, 1919, and done its duty at ELTA, G-EAJQ was put into storage pending sale. In August 1920 it was bought by Henry Woodland Beazing Hansford of Beaminster in Dorset. Hansford had qualified for Royal Aero Club Aviator's Certificate No 6413 on a Royal Aircraft Factory B.E.2c at the RAF Training Establishment at Sleaford, Lincolnshire, on November 27, 1918, while serving as a second lieutenant in the Yorkshire Regiment.

He obviously intended to operate a joyriding business, as he had a large triangular logo painted on the fuselage sides beneath the cockpits, under the word "AVRO". Inside the triangle was the legend "Hansford's Aeroflights" above a large bird with outstretched wings. Any ambitions Hansford might have had were short-lived, however, as the aircraft crashed at Honiton in Devon on September 28, 1920, only a month or so after he had acquired it. That seems to mark its demise.

These two recently acquired images of this little-photographed 504K almost certainly depict the accident. The aircraft does not appear to have suffered major damage, but perhaps Hansford decided that joyriding was not for him. Hansford's Aeroflights is not among the many joyriding outfits listed in Colin Cruddas's book *Those Fabulous Flying Years* (Air-Britain, 2003), and I have not found anything else about the business.

This previously unseen pair of photographs shows Avro 504K G-EAJQ on its port wingtip after a bad landing at Honiton in Devon in September 1920; the close-up shows the Hansford Aeroflights logo. Although the aircraft appears not to have suffered too much damage, it was withdrawn from use and written off after barely more than a month in use as a pleasure-flying machine. Presumably Hansford lost heart in the venture after the accident.

THE GREATEST ADVENTURE SINCE MEN FOUGHT ON EARTH...OR FLEW OVER IT!

ALL IMAGES RICHARD T. RIDING

THE MIRISCH CORPORATION PRESENTS

RICHARD T. RIDING IN 633 YOU CAN'T KILL A SQUADRON

The Winged Legend Of World War II

MARIA PERSCHY HARRY ANDREWS DONALD HOUSTON

DIRECTED BY WALTER E. GRAUMAN

SCREENPLAY BY JAMES CLAVELL and HOWARD KOCH

EXECUTIVE PRODUCER LEWIS J. RACHMIL · PRODUCED BY CECIL F. FORD · RELEASED THRU UNITED ARTISTS

COLOR by DE LUXE PANAVISION®

In 1964 aviation photographer **RICHARD T. RIDING** was offered a rare opportunity to capture the majesty of a Mosquito in its element during a ferry flight of one of the stars of *633 Squadron*, in which the cast proved that the term "wooden wonder" applied not only to the aircraft. A stuttering Merlin, however, meant that he had to be quick on the draw . . .

DURING 1963-64 Bovingdon aerodrome in Hertfordshire resounded to the growl of the Rolls-Royce Merlin engines of the de Havilland Mosquitoes of a fictitious fighter-bomber squadron. Mirisch Films had acquired several Mosquitoes, including two Airspeed-built B.35s, later converted to TT.35s for target-towing, to turn author Frederick E. Smith's 1956 novel *633 Squadron* into a blockbuster film to be directed by Walter Grauman, himself a wartime USAAF North American B-25 bomber pilot. The film was to be the first aviation feature film shot in colour and Panavision widescreen.

ACTION!

The action was based around an attack by the eponymous squadron on a German V2 rocket-fuel plant hidden away among the Norwegian fjords; the object is successfully accomplished but at the cost of the entire squadron, engendering some soul-searching in the film's last lines:
Sqn Ldr Adams: "Well, at least the rockets won't happen."
Air Vice-Marshal Davis: "Of course they'll happen. But they won't start tomorrow, or this month or on D-Day, and that's important."
Adams: "Then what does it all add up to? All their sacrifice?"
Davis: "A successful operation."
Adams: "But they're probably all dead. All 633 Squadron."
Davis: "You can't kill a squadron."

Stirring stuff.

The flying shots are memorable, as is Ron Goodwin's theme tune, but the crash sequences, using what appears to be oversized plastic models, were both regrettable and forgettable.

Responsible for keeping the Mosquitoes flying was John "Tubby" Simpson of Simpsons Aeroservices Ltd, based at nearby Elstree. Tubby woud later take charge of all the Rolls-Royce Merlin 500-engined aircraft — friend (Spitfires and Hurricanes) and foe (Spanish-built Heinkel He 111Hs and Messerschmitt Bf 109s) — gathered together for the 1969 film *Battle of Britain*. Tubby and his staff were indispensable backroom boys on both productions.

Some 20 years before the making of *633 Squadron*, Simpson had been the Mosquito Flight Shed Superintendent at Leavesden, overseeing the production and test flying of several marks of Mosquito. Having amassed and stored a headful of knowledge about the workings of various marks of Merlin, he was an ideal choice for keeping the Merlin 113A/114As of the TT.35s turning and burning.

In September 1964 John Schooling, my late friend and former chief flying instructor for the London School of Flying (LSF) at Elstree, was scheduled to ferry Mosquito TT.35 G-ASKA/RS709 from RAF Abingdon to Staverton, where some of the filming of *633 Squadron* had taken place. John asked me if I would take some air-to-air photographs of him en route; I didn't wait to be asked twice!

PREVIOUS PAGE ***One of the three photographs the author managed to take of de Havilland Mosquito TT.35 RS709 over the Cotswolds before engine issues forced John Schooling to peel away to land at Staverton in September 1964.*** **ABOVE RIGHT** ***The author during a photo-sortie in another Tri-Pacer, G-ARYH, in the summer of 1964.***

ABOVE LEFT ***Photographed through the cockpit access door, Stafford Dovey of Simpsons Aeroservices Ltd smiles as he dodges intense flak over Berlin in Mosquito RS712 – in his dreams!*** **ABOVE RIGHT** ***Stafford and fellow Simpsons engineer Dave Vince work on the starboard Merlin engine of RS712 at Elstree in September 1964.***

The morning of September 24 dawned fine, and with LSF instructor Andy Pankhurst as pilot we left Elstree in the school's Piper Tri-Pacer, G-APTP, minus its port passenger door, and landed at Abingdon 25min later. Shortly afterwards we took off again and headed westwards towards Staverton, rapidly pursued by John in the Mosquito. As he approached on the port side I could hear the Mossie's Rolls-Royce Merlins via the doorless aperture through which my K.20 aerial camera was in my hands ready and waiting. A few seconds later a voice crackled over the intercom and announced that there was a problem with one of the Mossie's engines; John was going to break away and hightail it to Staverton as quickly as possible.

So, frustratingly, just as the Mossie was closing in, it peeled off and rapidly disappeared from view towards Staverton. I only had time to take three photographs. We landed at Staverton 50min after taking off from Abingdon and later that afternoon we all returned to Elstree. Subsequently John gave many trouble-free displays in the Skyfame Aircraft Museum's Mosquito, TA719, also a star of *633 Squadron*.

The two Mosquitoes featured in these photographs — RS709 and RS712 — still survive today. The former is displayed at the National Museum of the United States Air Force in Dayton, Ohio, and is painted up as NS519, a PR.XVI of the USAAF.

Since 1987 RS712 has been owned by American collector Kermit Weeks. Re-registered N35MK, the Mossie is currently exhibited at the EAA Museum at Oshkosh, still wearing its *633 Squadron* markings as RS712/EG-F. Neither aircraft is airworthy, but with the recent return to the air of immaculate examples built in New Zealand, we may yet see the graceful shape of the much-loved "wooden wonder" back in British skies.

633 SQUADRON'S MOSSIES

A TOTAL OF eight Mosquitoes was used for the filming of *633 Squadron* during 1963–64:

RS709 Airspeed-built B.35 converted to TT.35. Sold 11.7.63; reg'd G-ASKA. On display at the National Museum of the USAF, Dayton, OH, USA
RS712 As above. Sold 11.7.63; reg'd G-ASKB. On display at the EAA AirVenture Museum, WI, USA
RS715 As above. Struck off charge (SOC) 18.9.61. Cockpit section only used in film
RS718 As above. SOC 19.6.62. Written off in simulated crash sequence in film
TA639 Built by D.H. at Hatfield as a B.35 and conv. to TT.35. On display at RAF Museum Cosford, UK
TA719 As above. Sold to Aviation Film Services 11.7.63; reg'd G-ASKC. On display at the Imperial War Museum, Duxford, UK
TJ118 As above. SOC 18.9.61. Cockpit section only used in film
TV959 Built by D.H. at Leavesden as a T.3. SOC 31.5.63. Not flown during film
TW117 As above. On display at the Royal Norwegian Air Force Museum, Oslo, Norway

ABOVE *John Schooling coaxes RS709 closer to the Piper Tri-Pacer camera aircraft en route from Abingdon to Staverton. Built by Airspeed at Christchurch as a B.35 in 1946, RS709 was converted to a target-tug and served with No 236 OCU and Nos 3 and 4 CAACUs in RAF service.*

LEFT *Simpsons Aeroservices engineer Dave Vince performs checks on the starboard Rolls-Royce Merlin 114 engine of RS712. Also converted to TT.35 configuration from a B.35, RS712 was sold in July 1963 and put on the British register as G-ASKB.*

BELOW *The airworthy TT.35 target-tugs were modified to resemble Mosquito FB.VI fighter-bomber variants, their clear nose sections and side windows being painted over before the fitting of dummy gun barrels. Here RS712 awaits maintenance on its starboard Merlin.*

In surprisingly good condition after nearly four decades as a static exhibit beside the Don Q Inn at Dodgeville, Wisconsin, Boeing C-97G N227AR is something of a local landmark. Residents of the town still remember the day it arrived in October 1977, film of which may be seen on the* TAH *website at www.theaviationhistorian.com.

AUTHOR'S PHOTOGRAPHS

OFF THE BEATEN TRACK

Ever turned a corner to find something unexpected? The Aviation Historian's *intrepid aeronautical explorer* ***PETER DAVISON*** *investigates the stories behind the oddities that turn up in the most unusual places*

SMALL TOWN USA often has big ideas. Such was the case in 1977 at the Don Q Inn at Dodgeville, Wisconsin, around 150 miles (240km) north-west of Chicago's O'Hare Airport. Don Quinn was a former World War Two pilot with a flair for self-promotion who found an unwanted but serviceable Boeing C-97G at Long Beach, California, and dreamed of fitting it out as a café at Dodgeville, which had an uphill 2,600ft (795m) grass airstrip beside Highway 23.

The big Boeing was built in 1953 as 52-2764 and after serving with the USAF was sold on to the private market as N227AR. It enjoyed a brief period as a television star in 1975 when it was used in two commercials for the Mercury Cougar car starring *Charlie's Angels* actress Farrah Fawcett, who signed the fuselage.

Following Don Quinn's acquisition of the aircraft two years later, it was flown to nearby Madison Airport for preparation work, and on October 16, 1977, N227AR made the short hop to Dodgeville, piloted by Dick Schmidt with Tom Thomas as copilot and Harold Waligorski as flight engineer. The C-97 landed in a huge cloud of dust at 1750hr, well within limits — after the windsock had been removed.

The café fit was never undertaken and I found the interior almost untouched during a visit in summer 2014. The airstrip has gone but the adjacent Don Q Inn, featuring 30 unusually-themed rooms, thrives to this day.

BELOW ***The distinctive cockpit of the C-97G in the summer of 2014. Much of the instrumentation remains in excellent condition. To get a bird's-eye view of the big Boeing on Google Earth, simply enter the co-ordinates 42.992182, -90.140436 in the "Fly To" box.***

Coming up in future issues:

The Burmese Triangle? *The late David Lockspeiser recalls a 1959 Hawker liaison trip to the Far East, in which he investigates a series of mysterious Sea Fury crashes in Burma*

Over The Weather *Edward M. Young takes a detailed look at TWA pilot "Tommy" Tomlinson's pioneering 1930s high-altitude research work in a Northrop Gamma*

Shadow Play *Dr David Baker tells the full story of Lockheed's ambitious CL-400* Suntan *supersonic hydrogen-fuelled very-high-altitude photo-recce spyplane*

TAH™

The Aviation Historian®

The modern journal of classic aeroplanes and the history of flying

Be certain to receive each new issue of The Aviation Historian *hot off the presses, by taking out a subscription. It's quick and easy to do. Issue 12 published July 15, 2015*

PRICES HELD SINCE LAUNCH IN 2012!

Annual Print Subscription for one year (4 issues): **£44** (UK), **£53** (Europe), **£62** (RoW)
For both print and digital versions, see our website for more details:

www.theaviationhistorian.com

TEL 07572 237737 **WRITE** TAH, PO Box 962, Horsham RH12 9PP, UK

Digital edition available via our partners pocketmags.com

Available on the App Store | Available on kindle fire | Available on PC & Mac | Available on BlackBerry | Available on the Google play

COMPLETE THE COLLECTION . . .

All print back issues of *The Aviation Historian* are currently still available via our website's Shop page, from £12.50 including p&p (UK).

Not on the web? Call 07572 237737 or write to us and we'll be happy to help!

***TAH* IS NOT AVAILABLE FROM NEWSAGENTS**

the hawk in africa / duncan menzies / the curtiss-langley controversy / stelio frati's first design / soviet russia and the liberty engine / SNCASO bretagne / beef by air / henry folland's piggyback bomber / alaska cold weather testing